The Electrical Industry's Weekly Magazine

October 9, 1961

Electrical World

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SUMMER is the peaking season now

...page 32

Arresters at River Crossings Solve Tripout Problems... p 34

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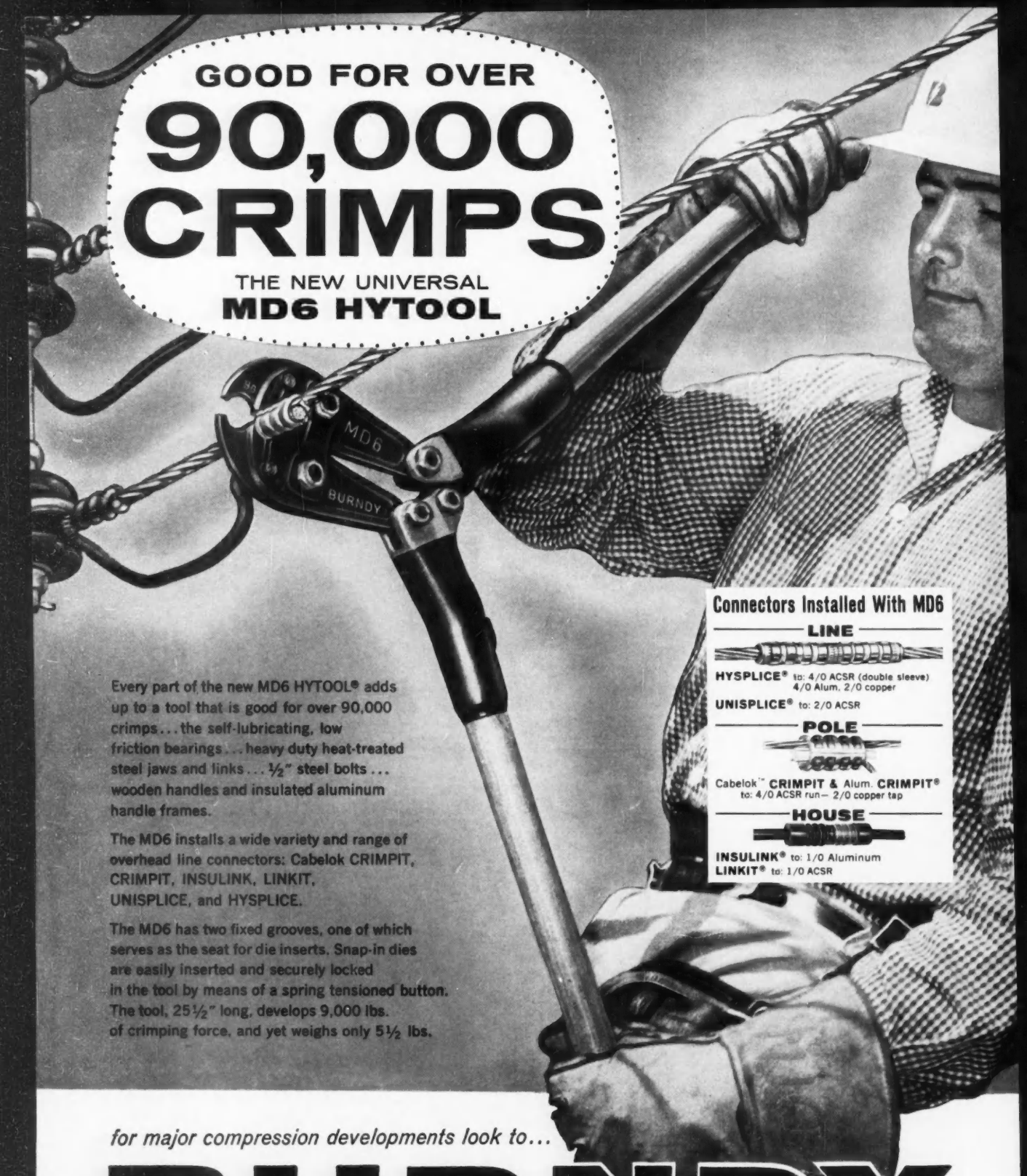

Every part of the new MD6 HYTOOL® adds up to a tool that is good for over 90,000 crimps... the self-lubricating, low friction bearings... heavy duty heat-treated steel jaws and links... ½" steel bolts ... wooden handles and insulated aluminum handle frames.

The MD6 installs a wide variety and range of overhead line connectors: Cabelok CRIMPIT, CRIMPIT, INSULINK, LINKIT, UNISPLICE, and HYSPLICE.

The MD6 has two fixed grooves, one of which serves as the seat for die inserts. Snap-in dies are easily inserted and securely locked in the tool by means of a spring tensioned button. The tool, 25½" long, develops 9,000 lbs. of crimping force, and yet weighs only 5½ lbs.

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INSULINK® to: 1/0 Aluminum
LINKIT® to: 1/0 ACSR

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Electrical World

October 9, 1961
Vol. 156, No. 15

Dateline . . .

What Did Congress Mean on Upper Colorado

Washington, D. C.—After the Senate and House of Representatives had heard testimony on who should build the contested Upper Colorado marketing lines, they each issued clear-cut reports on their positions.

The House wanted the Bureau of Reclamation to build them, and it provided money to get started. The Senate also provided money for the lines, but it directed the Interior Department to negotiate for five months with the five interested utilities on a possible private wheeling arrangement. There was no question on their stands.

But, when the Senate and House finally got together to compromise their differences, in the headlong dash to adjourn, they produced an ambiguous statement on the lines which has been taken as meaning: **(1)** Federal lines by some members of Congress, **(2)** Further negotiation on private wheeling by other members of Congress, **(3)** Federal construction of the contested lines and negotiation for wheeling on additional lines, at the ends of the contested marketing lines, by Interior.

Here's the language: "The conferees on the part of both Houses are in agreement that the planning and construction of the transmission lines for the Upper Colorado River Storage Project shall proceed as provided for in the budget presentation and in the bill as it passed the House, unless the Secretary of the Interior finds it practicable and in the national interest to enter into wheeling agreements with private power interests."

Members of Congress who favor the all-federal plan interpret the language their way because: **(1)** Money to build the lines is provided in the bill, the only thing on which both bodies of Congress really voted on, and **(2)** Contrasted to the strong directive in the Senate Appropriations Committee report (for negotiation), the conference language appears much less restrictive.

Other Congressmen who want the private lines, or at least more negotiation, point out that: **(1)** Whatever you make of it, the door for further negotiation is open, putting the responsibility on Secretary Udall, **(2)** The conference language, though unclear, forces the House to recognize the

(*Continued on page 5*)

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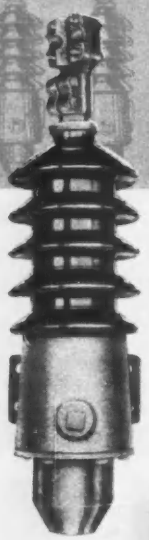

G&W Capnut Potheads have an enviable cost-saving record for service, dependability, and economy. They have maintained these values for over the last 40 years. The next 40 years should be even better.

G&W Capnut Style Potheads offer uniform design and quality features that provide practical, effective, trouble-free cable terminations in the medium-voltage class. The wide variety of standard types and sizes available simplifies proper selection of correct types for particular applications. You gain greater savings, safety, and installation convenience.

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superior quality standards — inspired specialized design

A 61-4

Dateline . . .

Washington, D. C. (*Continued from page* 3)
possibility of negotiation, and **(3)** there is even the hint that a formal finding is required.

Udall took this foggy legalism as his opportunity to get what he wanted all along: the all-federal system. And, in doing so, he compounded the confusion by more or less agreeing in his own way with all parties on Capitol Hill. Udall accepted a Congressional "decision" to build the contested all federal system, and he also accepted the Congressional "recommendation" to negotiate—but not on the same "yardstick" lines.

While Congress differed on whether the contested lines should be built federal or negotiated private, Udall agreed to both build and negotiate. Since you can't do both on the same lines, Udall had to add a new factor: he agreed to negotiate on other lines, not even mentioned in the hearings.

A source of confusion over Udall's plan is his use of the term, "backbone." Originally this referred to the uncontested federal integrating lines between the project dams. Udall now applies the term to his entire grid—integrating and marketing lines as well. So, when he said he would negotiate for wheeling beyond the backbone lines, he left the door open for an incorrect interpretation that he still planned to negotiate for the marketing lines.

How did this all come about? Congress produced the ambiguous statement, partly because it was in a hurry to go home, partly because many members of Congress just didn't have the technical grasp of the issues involved: Congress had accepted the conference language before Udall stated his plans, and then it adjourned before having had a chance to read them.

What next? If Udall declines any negotiations with the investor utilities on construction of the contested lines, how will he explain his actions to the Senate Committee next year?

Letters

Folsom Transmission Came 'First'

To the Editor:

I read with interest your article (EW, Sept. 4, p 37) on the plight of the Edward Dean Adams pioneer power plant, claiming for it "first" long-distance ac transmission—20 miles to Buffalo on Nov. 15, 1896.

Historical "firsts" are always subject to challenge. Although Niagara makes a bigger splash, Sacramento can claim priority on both date and distance. Three-phase ac electricity generated at Folsom on the American River was received in Sacramento at 4 am, July 13, 1895, transmitted at 11,000 volts over a line 22 miles long. An account of the event, which included the firing of a hundred-gun salute to the "New Era," is given in the Sacramento Union for July 15, 1895. A technical account, giving a detailed illustrated description, appeared in the Journal of Electricity. . . . The plant saw service until Nov. 13, 1952, when the dam was demolished in the course of construction of the new Folsom Dam and powerhouse on the American River.

California has been fortunate in preserving the original Folsom hydroelectric plant. Through the generosity of the Pacific Gas & Electric Co, the powerhouse and all its equipment were given to the State of California. With the fine cooperation of the State Division of Beaches and Parks and the Sacramento Section of the American Institute of Electrical Engineers, the site was dedicated as Historical Landmark No. 663 on Aug. 22, 1958, during the AIEE Pacific General Meeting held in Sacramento that year.

An interesting sidelight is that the building constructed to receive the power in Sacramento is still in use as part of the Sacramento Municipal Utility District's system—Station A.

We sincerely hope that some satisfactory solution to the problem of preserving the Edward Dean Adams Station can be reached. Preservation of such historical sites becomes increasingly important as "progress" threatens to engulf us all.

Charles R. Day
Manager, Engineering Department
Sacramento Municipal Utility District

This is your column in Electrical World. Correspondence should be addressed to Letters Editor, Electrical World, 330 W 42nd St, New York 36, N. Y.

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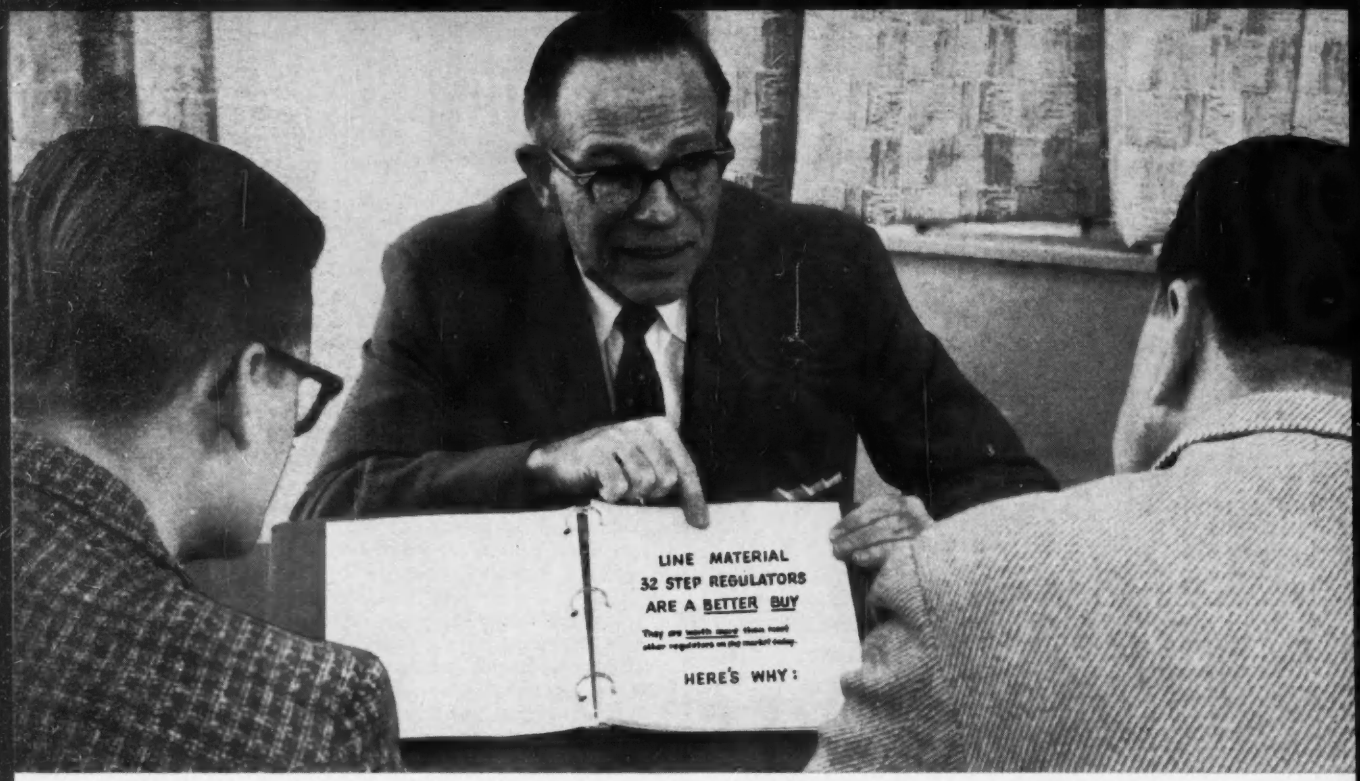


A. R. Waehner, Director of Transformer Product Sales, presents the story of L-M 32-step Regulators. Ask your L-M Field Engineer to show you why L-M Regulators are a better buy—how less weight permits cluster-mounting; how Round-Wound construction assures lower losses, higher short-circuit strength, how the design provides many other advantages in convenience, operation, reliability.

Ask Your L-M Field Engineer WHY L-M Regulators Are A Better BUY

Round-Wound® design provides better cooling, lighter weight for cluster-mounting, higher short-circuit strength. Voltage and band width adjustments are accurately made in minutes.

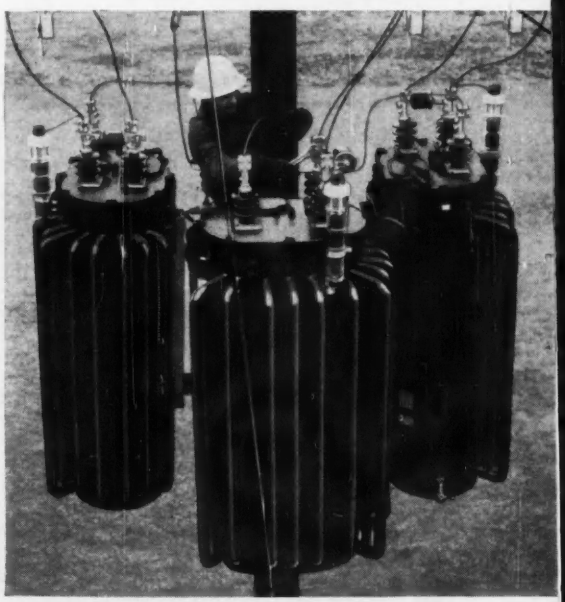
Only L-M's 32-step voltage regulators incorporate the Round-Wound principle of core-and-coil design. Round-Wound design provides faster heat transfer for better cooling.

More Compact—77% Lighter—Round-Wound core-and-coil assemblies are more compact. L-M regulators have shorter obround tanks requiring less oil. Up to 77% less weight permits cluster-mounting.

Higher Short-Circuit Strength—L-M's exclusive round coils withstand mechanical stresses of short-circuit currents better than other designs.

Rugged, Reliable—Only L-M regulators have the exclusive induction disc watt-hour type contact-making voltmeter. Control is more accurate, reliable and rugged. Calibration is easier with no interruption in service.

Get The Whole Story—Your L-M Field Engineer has the complete story on L-M's 32-step voltage regulators. Contact him today or write Line Material Industries, P.O. Box 510, Zanesville, Ohio.



5000 KVA OF LOAD REGULATED FROM A SINGLE POLE! Here three L-M 219 ampere, 7620 volt regulators are cluster-mounted to provide regulation on a 7620/13200 volt multi-grounded wye distribution feeder.

OUR 50TH YEAR 1917 – 1951

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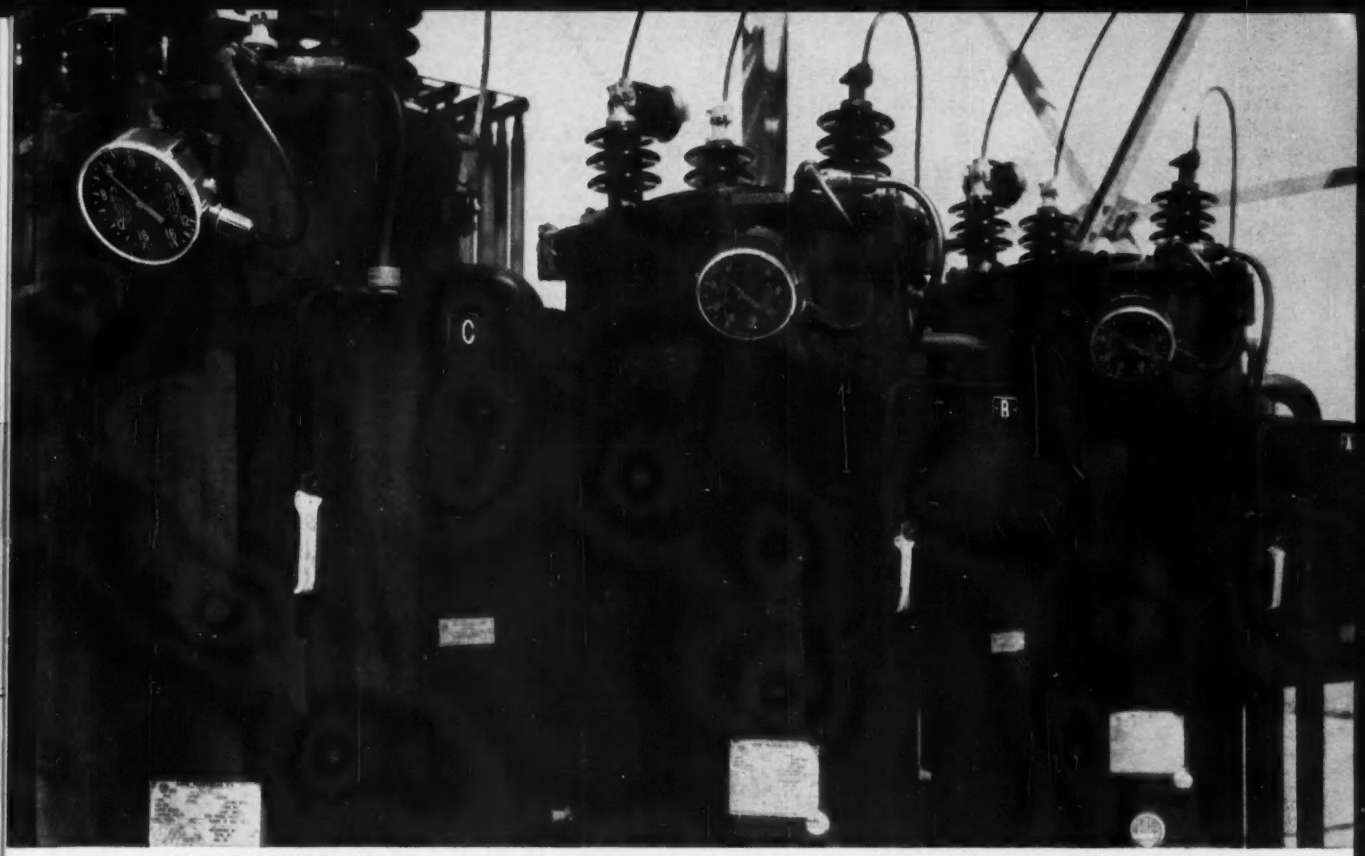


THE NEW TYPE ES electronic sensing device designed by L-M for its type RSD regulators is readily accessible in the externally mounted control cabinet. Here is a substation installation by a midwest utility.

New L-M Electronic Regulator Control Cuts Maintenance, Ups Speed, Accuracy

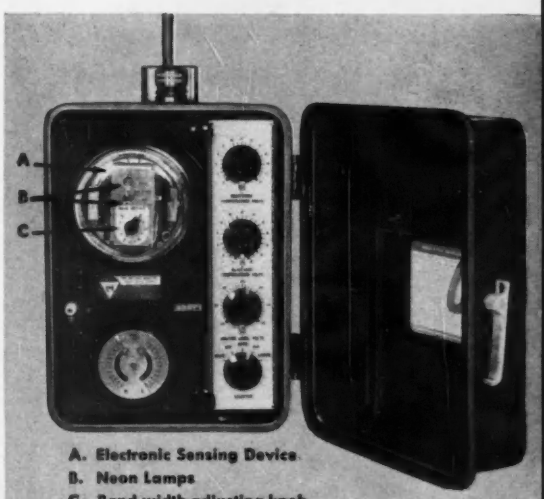
L-M announces revolutionary new type ES Electronic Sensing Control for L-M Voltage Regulators. Eliminates contacts and their maintenance; eliminates moving voltmeter parts; provides faster, sharper response, constant band width.

Recently L-M engineers have replaced the accurate contact-making voltmeter in L-M regulators with an even more precise and dependable electronic sensing control. This control has been thoroughly tested. Completely static parts provide utmost reliability, and extremely sharp and fast response to voltage variations.

Now there are no moving parts to wear out or malfunction. No contacts in the sensing mechanism to erode and require replacement. Band width easily set by adjusting knob on face of meter. Band width may be adjusted from ± less than one volt to ± 6 volts. Two neon lamps indicate when voltage is outside band width. Upper lamp lights for high voltage, lower for low voltage. Once set, band width will not drift from desired setting.

Get Details From The L-M Field Engineer

L-M offers a really outstanding regulator. And L-M's new electronic control is outstanding, too. Investigate, test, and standardize on L-M Voltage Regulators. To convince yourself, ask the L-M Field Engineer for bulletins and application data. Or write Line Material Industries, Milwaukee 1, Wisconsin.



A. Electronic Sensing Device
B. Neon Lamps
C. Band width adjusting knob

L-M'S EXCLUSIVE NEW electronic sensing device for L-M Voltage Regulators. Transistors assure fast and extremely accurate response to voltage changes. Maintenance is reduced because there are no contacts to erode and replace.

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Regulators

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Wet flashover values increased 20% by electrostatic rain deflectors on Lapp Station Posts

As operating voltages increase, heights of station insulators increase correspondingly. And as heights of insulator stacks go up, the tendency increases for lower insulators to flood under heavy rain conditions.

A Lapp development (Lapp Patent No. 2884479) is the electrostatic rain deflector. This is a metal plate located at each bolted joint between component insulators. It uses the electrostatic field surrounding the insulator to disperse the water as it flows down from the upper portion of the insulator, throwing it outward and eliminating flooding over the lower portion. In tests, Station Posts with the electrostatic rain deflectors show 20% increase in wet flashover characteristics over Posts without these devices.

In addition, design of these deflectors cooperates ideally with the principle of Lapp Fog Type leakage surfaces. Small in diameter, the rain deflectors permit insulator surfaces to be wetted all over without imposing dry shielded areas where leakage current can quickly cause sparking; yet under rain will prevent excess flow of contaminated water over lower sections.

For all high-voltage, EHV, and contemplated EHV, Lapp Station Posts offer superiorities in rigidity, ease and simplicity of construction, adaptability for use inverted or horizontally, operation under dirt conditions, and dependable long life. Units (with Lapp electrostatic rain deflectors at *every* bolted connection) are available in three strength classes at ratings of 900 BIL, 1050 BIL; in two strength classes at 1300 BIL, 1470 BIL, 1640 BIL, 1800 BIL and 2100 BIL. Write for Lapp Brochure No. 548—a critical examination of station insulators for high-voltage application.

Lapp Insulator Co., Inc., Le Roy, N. Y.

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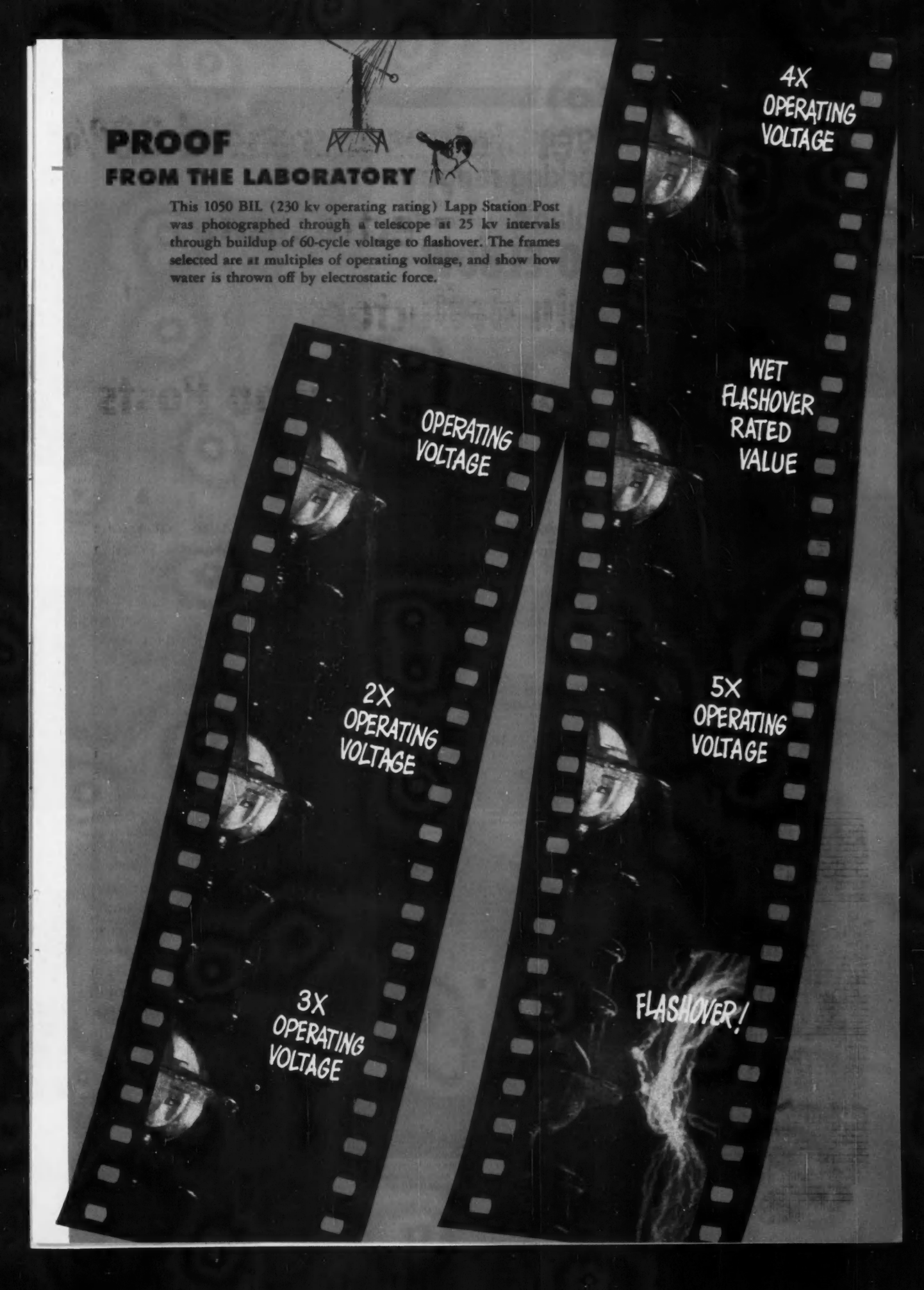
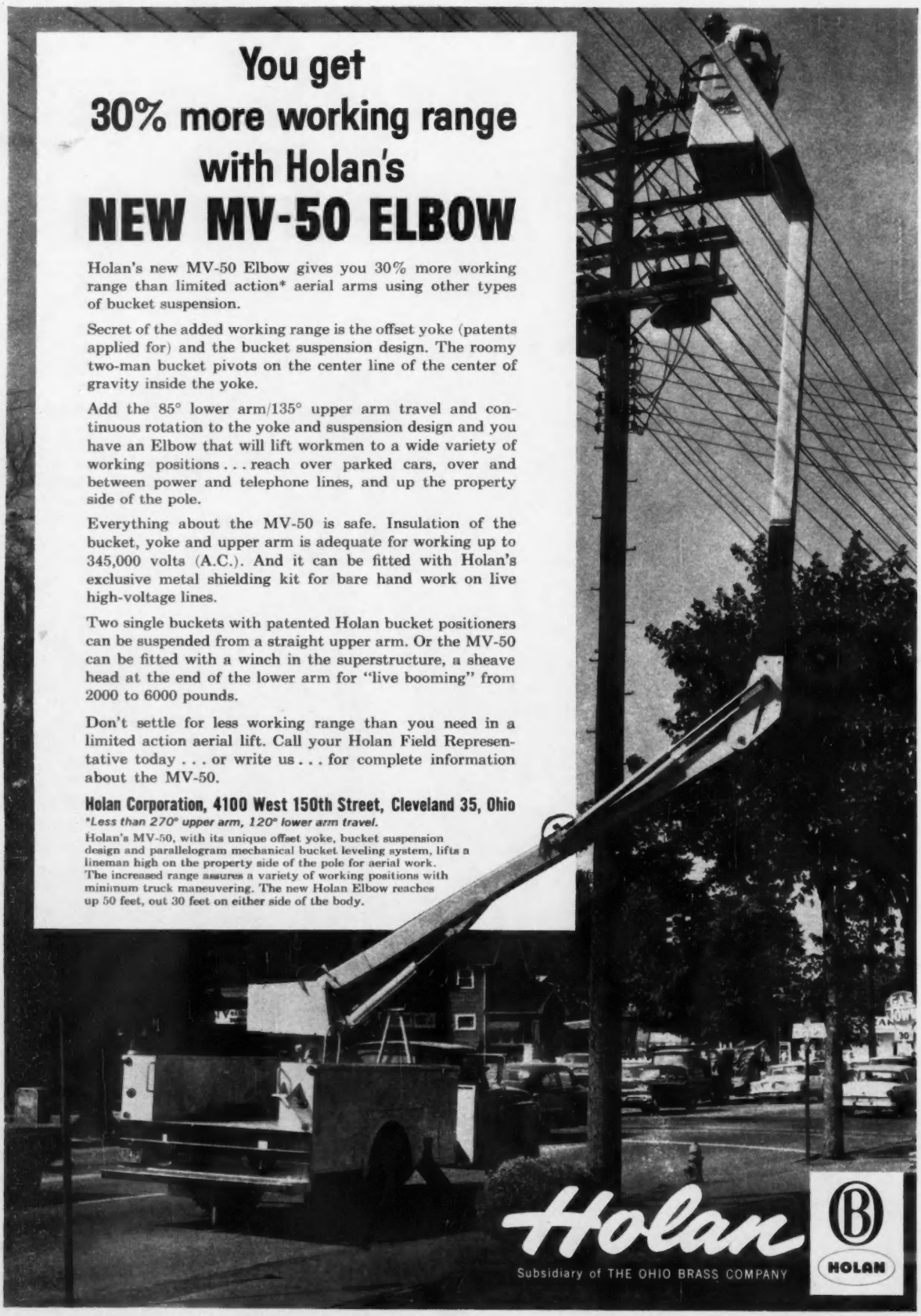

PROOF
FROM THE LABORATORY
This 1050 BIL (230 kv operating rating) Lapp Station Post was photographed through a telescope at 25 kv intervals through buildup of 60-cycle voltage to flashover. The frames selected are at multiples of operating voltage, and show how water is thrown off by electrostatic force.
OPERATING VOLTAGE
2X OPERATING VOLTAGE
3X OPERATING VOLTAGE
4X OPERATING VOLTAGE
WET FLASHOVER RATED VALUE
5X OPERATING VOLTAGE
FLASHOVER!



You get 30% more working range with Holan's NEW MV-50 ELBOW

Holan's new MV-50 Elbow gives you 30% more working range than limited action* aerial arms using other types of bucket suspension.

Secret of the added working range is the offset yoke (patents applied for) and the bucket suspension design. The roomy two-man bucket pivots on the center line of the center of gravity inside the yoke.

Add the 85° lower arm/135° upper arm travel and continuous rotation to the yoke and suspension design and you have an Elbow that will lift workmen to a wide variety of working positions . . . reach over parked cars, over and between power and telephone lines, and up the property side of the pole.

Everything about the MV-50 is safe. Insulation of the bucket, yoke and upper arm is adequate for working up to 345,000 volts (A.C.). And it can be fitted with Holan's exclusive metal shielding kit for bare hand work on live high-voltage lines.

Two single buckets with patented Holan bucket positioners can be suspended from a straight upper arm. Or the MV-50 can be fitted with a winch in the superstructure, a sheave head at the end of the lower arm for "live booming" from 2000 to 6000 pounds.

Don't settle for less working range than you need in a limited action aerial lift. Call your Holan Field Representative today . . . or write us . . . for complete information about the MV-50.

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio

**Less than 270° upper arm, 120° lower arm travel.*

Holan's MV-50, with its unique offset yoke, bucket suspension design and parallelogram mechanical bucket leveling system, lifts a lineman high on the property side of the pole for aerial work. The increased range assures a variety of working positions with minimum truck maneuvering. The new Holan Elbow reaches up 50 feet, out 30 feet on either side of the body.

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

Why Westinghouse is one of world's leading suppliers of nuclear fuel elements and complete cores

Quality Control. High sensitivity, immersion ultrasonic inspection of tubular and plate fuel elements detects flaws and simultaneously provides written records. Other special quality control equipment includes x-ray, chemical, and metallographic laboratories, eddy current and leak testers, and panoramic cameras for filming internal surfaces.

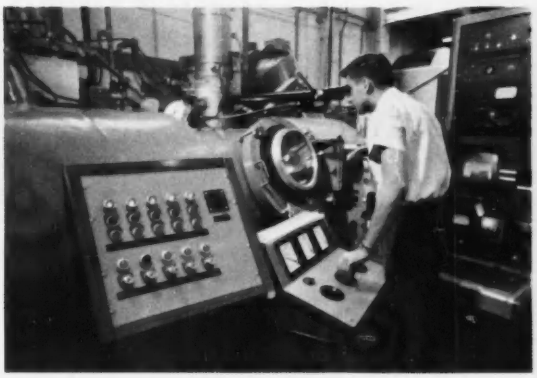
Rods and Assemblies. This technician is welding a stainless steel fuel rod. Westinghouse successfully fabricates aluminum, zircaloy and stainless steel rods and assemblies. Rods can be up to 1" in diameter and up to 130" long. Assemblies can be up to several thousand pounds.

Fuel Development Laboratory. Each job is completely pre-engineered in a commercial fuel development laboratory. This engineer is sintering cermets in an experimental furnace with instrumented vacuum unit. Laboratory has equipment for development work on all types of potential fuel materials and processes.

Modern Equipment. Facilities include pre-sintering and sintering furnaces (shown above), special vacuum welding boxes, vacuum annealing and vacuum induction melting furnaces, autoclaves for corrosion testing, rolling mills for hot and cold rolling, brazing equipment, brake presses for tube forming and plate bending. Other special production equipment includes a 48' high core assembly room with complete optical alignment and gaging equipment.

Atomic Fuel Department. Westinghouse provides industry with a completely equipped, integrated fuel fabrication facility, located at Cheswick, Pa. Products include pellets in any enrichment, pellet loaded and plate-type fuel elements, core components and completely assembled nuclear cores.

High Quality Pellets. Westinghouse can produce solid, hollow or spherical pellets, in sizes from .100" to approximately 1". A.F.D. has three compartmented pellet lines capable of simultaneously producing UO_2 pellets of three different enrichments.



Electron Beam Welder. This 48" diameter, 28' long vacuum chamber encloses a 2 kw, 150 kv electron beam welding head. Unit is capable of welding pieces up to 24" in diameter, 10' long, at speeds up to 100" per minute. Equipment is used for welding aluminum fuel elements and permits closely controlled welds in refractory metals.

JI-59504

Westinghouse

Undetected flame failure can cause costly interruptions, do serious damage to expensive equipment and endanger lives. To prevent such loss, Honeywell has developed an ultraviolet flame detector that won't be fooled, because it positively differentiates between flame and hot brick.

This flame detector senses only the flame!

No more hot refractory hold-ins!

For the first time, you can be absolutely sure that fuel delivery will be stopped in the absence of flame. Honeywell's C7012A Ultra-Vision* Flame Detector employs an amplified ultraviolet signal to positively distinguish between an actual flame (ultraviolet rays) and a hot refractory (infrared rays). This revolutionary new device represents a major breakthrough in scientific flame detection.

Not only is the Ultra-Vision Flame Detector compact. It also simplifies flame supervision of both single and multiple burners because, not being sensitive to a hot refractory, it can be aimed at each individual flame in the most convenient way. It is the only control device on the market that offers you this advantage.

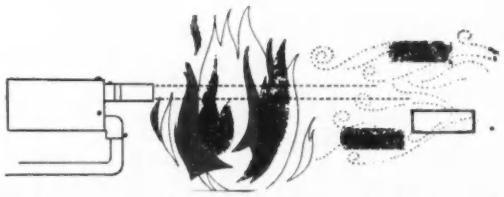
Is it economical? This amazing new flame detector will actually save you money in simplified installation and maintenance. Wiring is less expensive in this system than in a lead sulphide cell. It is easier to install because hot refractory can be ignored. And there is no further need for flame rod replacement.

For complete details, call your nearby Honeywell office. Or write Honeywell, Dept. ET-6-24 Minneapolis 8, Minnesota. In Canada, write Honeywell Controls, Limited, Toronto 17, Ontario.

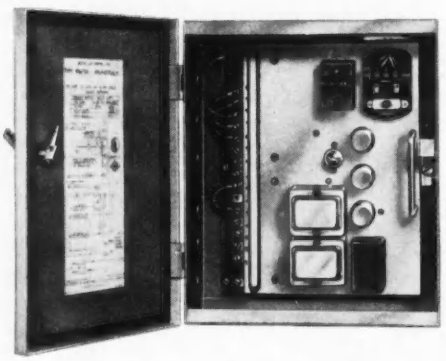
Honeywell

First in Control

SINCE 1885



Honeywell's new Ultra-Vision Flame Detector sights the flame of all fuels, but is not affected by hot brick. It does a more effective job on single burner pilot and main flame installations. And now, for the first time, multiple burner installations can also be monitored safely.



Honeywell's new R4075 Protectoglo* Flame Safeguard Relay features a "maximum-safety" self-checking circuit to continuously supervise constantly burning industrial burners. The mounting cabinet has all-voltage terminals and a quick-disconnect control base that allows this electronic flame safeguard to be completely removed without disconnecting any of the wiring.

Trademark

Electrical World

OCTOBER 9, 1961
Vol. 156, No. 15

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MERGED INDUSTRY EFFORT is vital to capture heating load, conference hears.

LATE NEWS ▶ **The transportation industry must help to lower** the delivered price of coal, says S. L. Jewell, vice president of Peabody Coal, in a speech before the Southern Research Institute Conference. The coal industry, says Jewell, has cut the price of coal at the mine by 6% since 1948 despite a 72% increase in wages and a steady rise in other costs. But railroad freight rates on coal rose 25% in the same period.

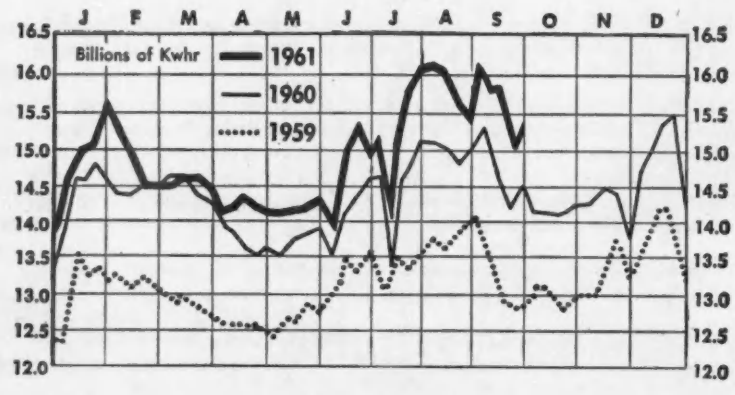
Pennsylvania Electric Co is working on eight interconnections with neighboring utilities, Penelec President L. H. Roddis tells the Eighth Annual National Electric Farm Power Conference. Upon completion in May of next year, these lines will create a link between the Middle Atlantic, New York, New England, and Midwest power pools.

Iowa Utilities Annual Management Conference hears Arthur Barnett, National Assn of Electric Companies, explain that federal power policy is being formulated on assumption that preference customers have power needs which only federal government can supply and that federal government has the obligation to meet the needs of preference customers everywhere. Basing his deductions on statements by Administration officials, Barnett also feels federal lines will be built wherever possible to link federal hydro projects into a national grid, to which will be linked federal atomic power plants as they are authorized. Co-op thermal plants will be encouraged and tied to the grid.

Two competitors comment on General Electric's announced price increase for power transformers. **Allis-Chalmers:** "The severe squeeze on profits resulting from the highly competitive market of electrical equipment in general has indicated that better prices are overdue. We are not satisfied that the increase on power transformers announced by General Electric Co is sufficient, but we recognize that we must be competitive." **Westinghouse:** "We have received conflicting reports concerning a GE announcement of a power transformer price increase. We anticipate that bidding in the next few days will reveal exactly what types of transformers are affected, and the exact amount of the change. An increase in power transformer prices appears to be justified in order to support development programs needed to assure our customers of continued improvement in value received. When more information is available, we will give consideration to the possibility of a change in our prices."

British Labor Party votes to expell the 240,000-member Electrical Trades Union on grounds that it is communist-controlled. This is first time in history of the party a labor union has been expelled.

WEEKLY POWER OUTPUT—Up 8.3% (Week ending Sept. 30), Kwhr 15,340,000,000



Per Cent Change From Previous Year

	Sept. 16	Sept. 23	Sept. 30
Total U.S.	+11.0	+ 3.2	+ 8.3
New Eng.	+19.3	+ 8.5	+ 9.1
Mid. Atlan. ...	+21.3	+ 7.9	+ 6.6
Cent. Indust. ..	+10.0	+ 4.4	+ 5.2
West Cent.....	+13.5	+ 2.7	+ 7.2
Southeast	+11.1	+ 4.5	+10.7
South Cent.	+ 2.5	−12.9	+19.3
Rocky Mount...	+11.8	+ 1.9	+ 2.2
Pacific			
NW	+ 5.8	+ 3.0	+ 5.8
SW	+ 6.8	+ 6.7	+ 7.9

Seasonally Adjusted Index 298
Week Ago 290 Year Ago 275

Source: Edison Electric Institute

LINE MATERIAL'S WHEATON APPRAISES UTILITY EQUIPMENT MARKET PLACE

A frank appraisal of the current electric utility equipment market place was the highlight of a speech delivered recently by Line Material Industries President R. G. Wheaton before the Rocky Mountain Electrical League.

Wheaton attributed the "deplorable profit situation in the equipment industry" to a number of factors—"general chaos in the market place attributable to the Philadelphia cases, the threat of foreign competition, some measure of overcapacity, and over-emphasis on price and the lack of courage to quote and hold firm to reasonable prices predicated on costs and fair return on investment.

"Let me say 'right-off-the-bat'," he continued, "I believe our market conditions are very largely what we in the manufacturing business make them or permit them to be. To be sure, in some instances in our negotiating with customers we are invited to 'go broke,' but I doubt if anyone expects us to accept. Never have I known of a situation where we were compelled to take an order. We are in a major way masters of our fate, although at times somewhat foolish in our reasoning.

"The general chaos which exists in the market place will disappear once the manufacturers recover from shock, get their feet on the ground, analyze their situation from a profit standpoint, and recognize where unsound practices in the market place carry us. Already, in a few product classifications, trends have changed in the market and some slight improvement evidences a slow return of reason and logic.

"To me, the threat of foreign competition must be met in a realistic fashion. Without question, we American manufacturers must offer our customers the best 'buy' available for their dollars. Regardless of relative labor costs here and abroad, through our ingenuity, technology, and diligence we must present over-all product values which our customers cannot afford to ignore. In instances where this cannot be accomplished, we are faced with the inevitable prospect of one way or another going out of that particular line of business.

"Overcapacity is a difficult problem to overcome . . . In the highly mechanized businesses which we operate today, the huge capital investment burdens attendant to mechanization are constantly with us whether plants are operating at capacity or not. Therefore, there is considerable compulsion to maintain volume at any price in order to 'pay the freight' on investment. Such practice seldom yields reasonable profit or adequate return on investment.

"During recent months my company has devoted endless hours to the development of a modern pricing philosophy. We hope to establish realistic price bench marks for our customers and ourselves. We believe we have an obligation to provide reliable, high quality products at prices which cover our costs plus a fair margin of profit . . . We believe sincerely in competition and competitive pricing of products made possible by improved developments and practices in our business. We are not interested, however, in 'price fighting' which has been described as 'the cutting of prices without regard to costs.'"

On the subject of the downward trend of manufacturers' earnings, Wheaton said this "can prove to be disastrous for all involved directly or indirectly with the industry. A manufacturer can cut quality and product reliability," he continued. "He can release manpower and render less service of all kinds. Research and new product development can be discontinued. By one path or another he can

end up in bankruptcy. If this happens, the buyer suffers a loss in values received during the process, competition is decreased and if the experience is common in an industry, monopolistic situations develop which are always undesirable and costly. In other words, just what the government is attempting to prevent could happen. No one benefits in the long run if profits disappear from large segments of an industry. In the final analysis the manufacturers, the customers, the industry, the economy, and the nation suffer a severe long term loss."

GE UPS POWER TRANSFORMER PRICES; ALUMINUM CONDUCTOR PRICES CUT

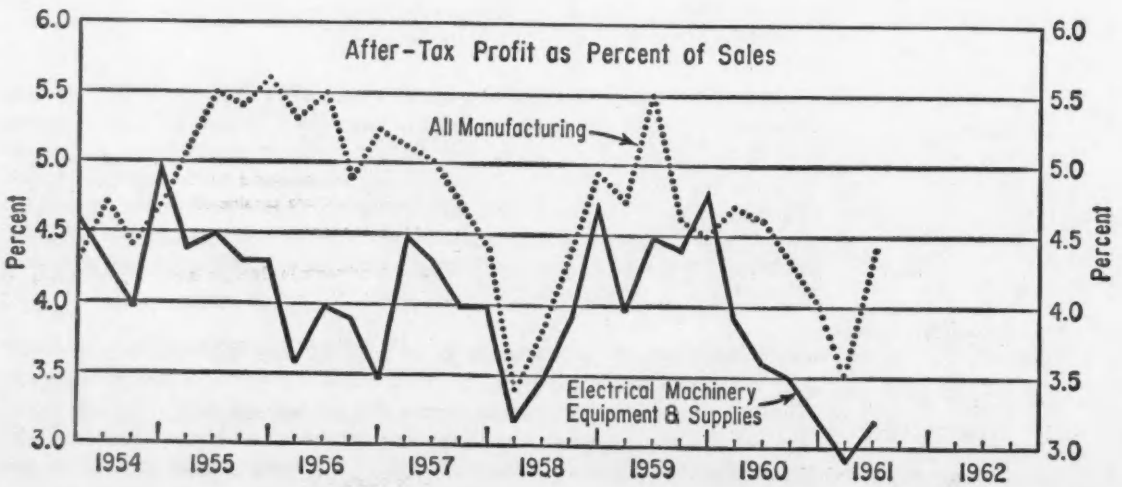
A 6% increase in the price of all transformers 501 kva and above has been announced effective Oct. 2 by General Electric Co. The company referred to the fact that it had "drastically reduced its transformer prices last year to reflect going market levels," and noted that the present "minor upward adjustment is necessary to maintain continued product innovation and improvement."

Meanwhile, the price of bare aluminum conductors has been reduced ½¢/lb by Alcoa's Rome Cable Division and Kaiser Aluminum & Chemical Corp following a 2¢/lb aluminum price reduction by the industry.

ALLIS-CHALMERS CUTS EMPLOYEES' SALARIES

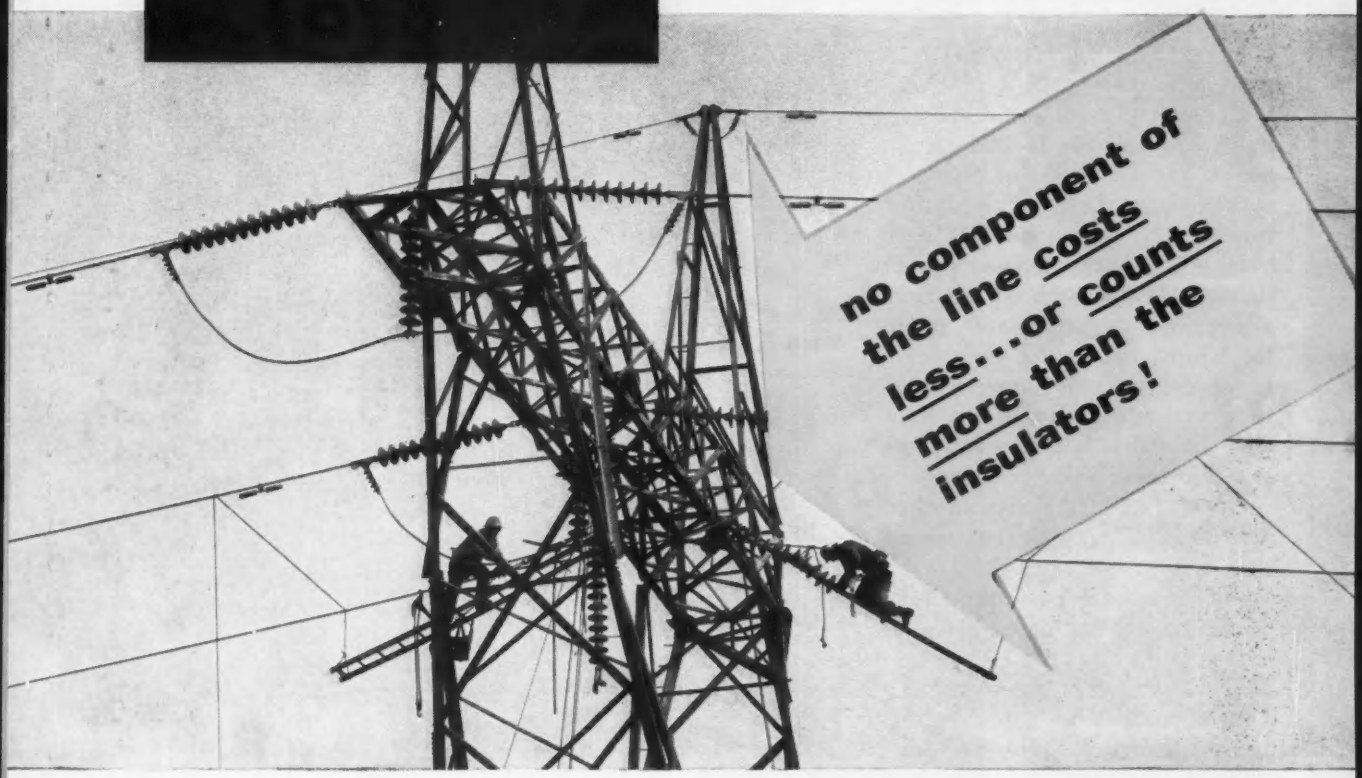
Allis-Chalmers Manufacturing Co has reduced the pay of its 13,000 salaried employees by 5% to 25%. In making the move last week, the company said the cut was only a stopgap, interim measure to increase profit margins. For employees making up to and including $10,000 annually, the reduction is 5%. Above $10,000 the reduction ranges from 10% to 25%. Earlier, the company had cut its third-quarter dividend to 12½¢ from the previously quarterly dividend of 37½¢ per common share. Earnings in 1961 were 15¢ per common share for the first quarter and 35¢ per share in the second quarter.

Meanwhile, profits for the whole electrical machinery, equipment, and supplies industry went up a bit in the second quarter, the government reports:



line cost– $85,000 per mile

insulators– $2,500 per mile



This tower has a busy future ahead. It's insulated now for a single 138-kv circuit. Later, it may carry a second 138-kv circuit. And eventually, it will support a bundled-conductor 345-kv line.

At the ultimate voltage, as shown in the figures above, cost of the O-B suspension insulators will total less than 3% of the cost of the line, including right of way.

No component costs less - - yet none is more important to the overall performance of this line.

For the purchaser of suspension insulators, this fact has a double-edged significance.

First, it means that the *overall cost* of a transmission line *cannot be materially reduced* by cut-rate prices on a component that accounts for only 3% of the overall cost.

Second - - and more important - - it means that *overall performance* of the line *can be materially reduced* by the cut-rate quality that usually accompanies cut-rate price.

Nowhere, in other words, do "penny savings" entail greater "dollar risks."

Your O-B representative has convincing proof of this in the form of a 25-minute sound-color film entitled, "The Second 50 Million."

Why not ask him to arrange a showing in your office?

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

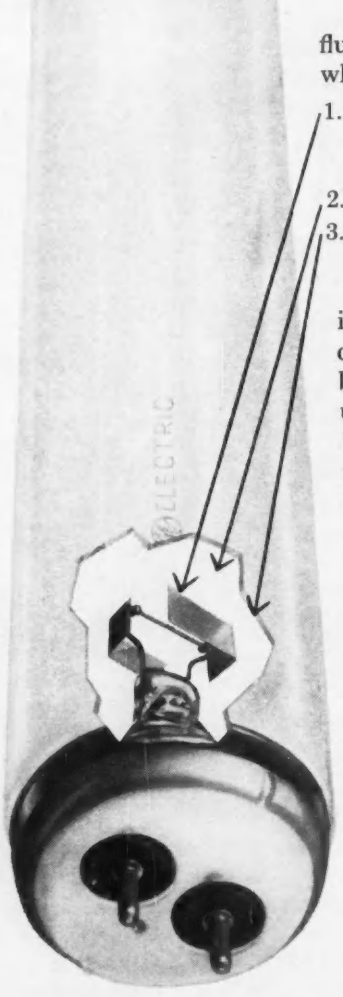
10085-H

Here's money-saving news about 40-watt fluorescents from General Electric

It's the brightest 40-watt cool white fluorescent ever made. With the General Electric NEW F40 you give your customers a 7% bonus in light at *no extra cost.* This extra light is worth 15¢ to 30¢ to most users. Yet the price of this lamp is the same as for ordinary fluorescents that give less light.

Now you can increase present lighting levels without charging a customer a single extra penny for lamps, fixtures or electricity. If you're putting in a new installation, you can give him the light level he wants with fewer lamps and fixtures.

General Electric scores another first in offering your customers this bonus in standard 40-watt "white" fluorescent lamps. The G-E NEW F40 is rated at 3100 lumens in popular cool white, 3250 in white or warm white. That's because of three light-producing G-E Premium 3 construction features available for the first time in a lamp that sells for the same price as ordinary fluorescents—only $1.30 for cool white, $1.35 for other "white" colors:



1. G-E wattage-miser electrode helps convert power ordinarily lost in the cathode into useful light—free.
2. New, more efficient gas mixture.
3. New electronically screened bonus-phosphor.

NEW F40 is rated at 7500 hours in Rapid Start and starter-type circuits (6000 in systems installed before 1954). In pre-'54 circuits use F40/54 lamps. They give 7500-hour life, same light as ordinary 40-watt fluorescents (2900 lumens) at the same price ($1.30 cool white). General Electric Co., Large Lamp Dept. C-123, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

NEW F40 ONLY $1.30 LIST

HARPER AVAILABILITY
. . . fastenings at your fingertips!

Immediately available, from stocks in local distributor and factory warehouses, are millions of fastenings in over 7,000 different sizes, shapes and alloys to meet your critical demands. Harper maintains a constant inventory of more than 150,000,000 bolts, nuts, screws, washers and rivets in over 100 non-ferrous and stainless steel alloys to make this service possible. Even "specials" made to your specifications are promptly processed through Harper's completely integrated operation to meet your requirements. Availability of fastenings is a fact with Harper. Call your local Harper Distributor or branch office today for proof!

shaping metals that shape your future

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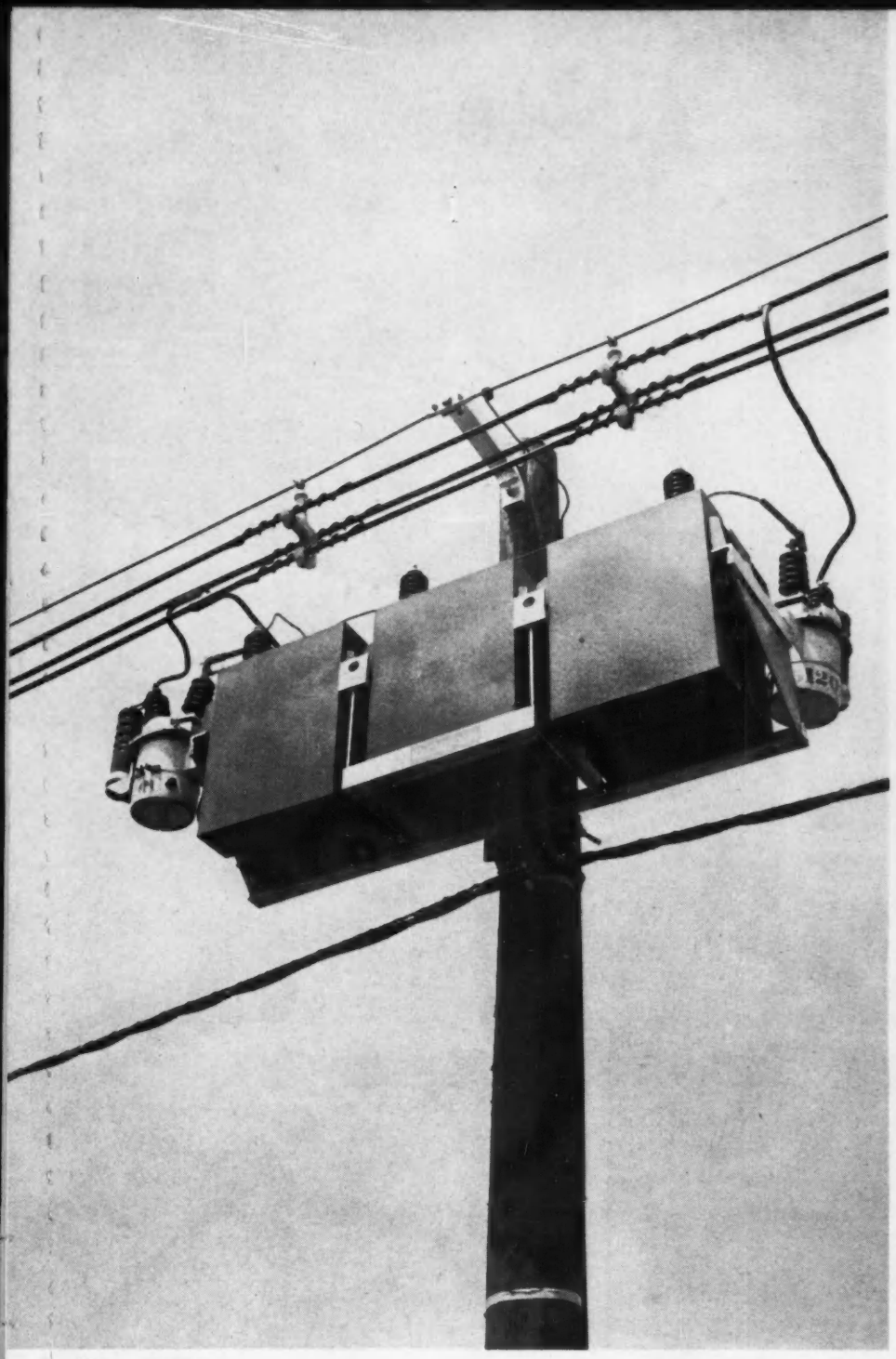
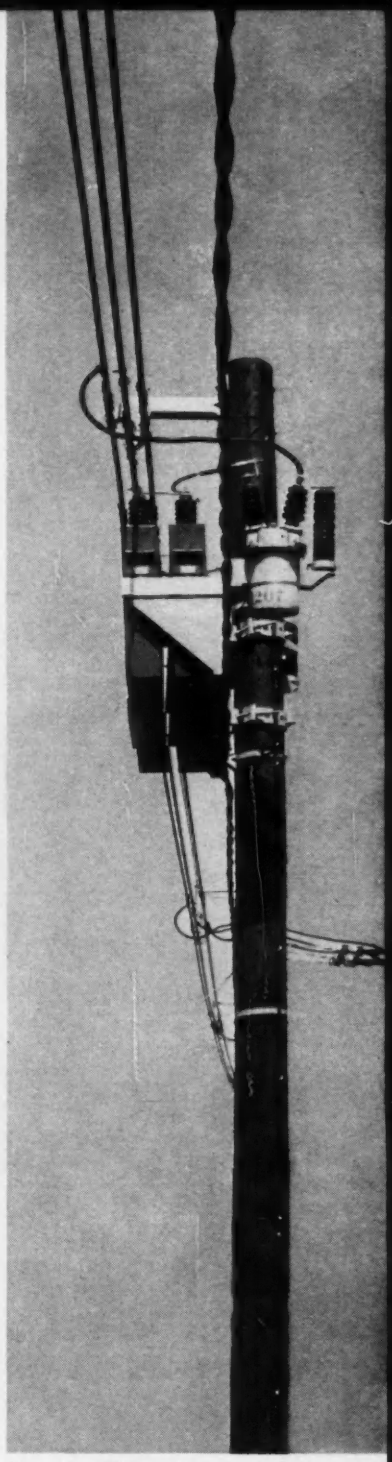
As received.

New Westinghouse Completely Self-Protected Autotrol saves more than $100 in installation costs— eliminates pole top clutter



90-minutes later.

J-65004



Slim silhouette, no pole top clutter.

This test installation on the above 600 KVAR, 13.8 KV Autotrol was made in less than 90-minutes by Public Service Electric and Gas Company; Newark, New Jersey.

This new Westinghouse Completely Self-Protected Autotrol® is delivered as a Complete Single Package. In addition to capacitor units, oil switches and junction box, the new Westinghouse CSP Autotrol has lightning arresters and fuse protection mounted directly on the switches. The cost of installing three arresters and three cutouts is eliminated, also the cost of the cross arm needed to hold them. Therefore, this compact design, which requires less pole space, may mean the difference between using an existing pole and installing a new, taller one. Just hoist up the Autotrol, anchor it to the pole, fasten three leads and it's on the line.

For complete information on this Westinghouse exclusive . . . call your Westinghouse Sales Engineer. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. You can be sure . . . if it's Westinghouse.

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Westinghouse

HILLER 12E
N53

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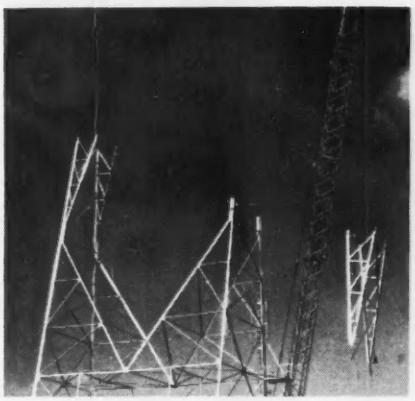
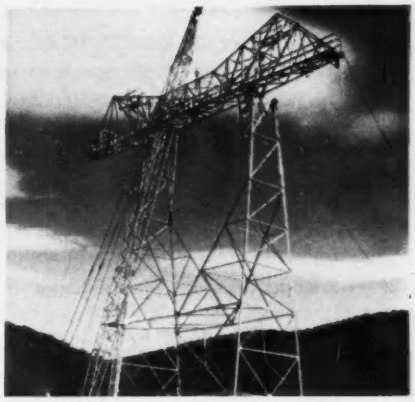
Alcoa® Aluminum. Dropped from the air or built straight up. ■ Designed and fabricated by Alcoa Structural Division for economy — speed — strength.





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Structural Division
871-K Alcoa Building
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ALCOA ALUMINUM

STRUCTURAL DIVISION

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a NEW Kearney Switch

BR★60

Double side-break switch for heavy duty jobs

The new BR★60 Switch was designed in response to the demand for economical heavy duty switching facilities required by increased loads in utility systems.

Its fundamentally simple design makes the BR★60 at once rugged, economical and easy to operate . . . exceptionally free from binding and the consequent wear and maintenance. The BR★60 has been fully tested in the Hubbard-Kearney laboratory.

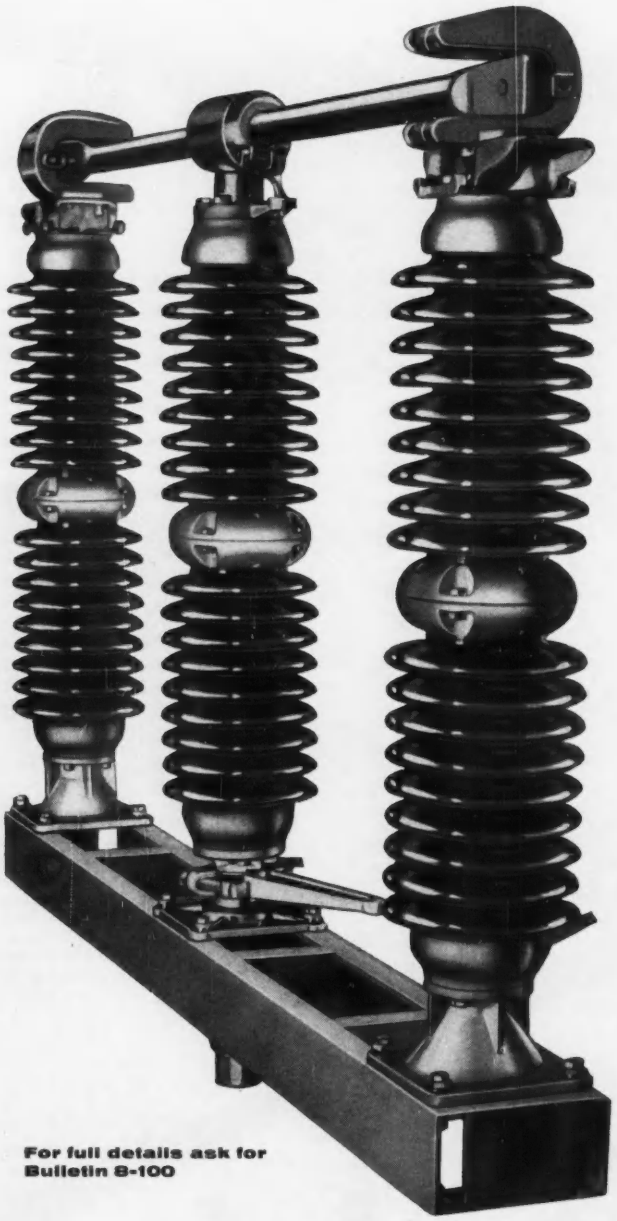
BR★60 is the ECONOMICAL answer to many switching requirements . . .

its price is surprisingly low for a heavy duty switch capable of handling:

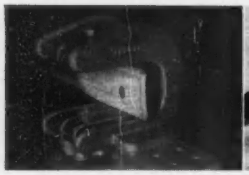
- Oil circuit breaker by-pass and isolation
- Bus sectionalizing
- Potential transformer disconnect
- Line isolation
- Lightning arrester disconnect

BR★60 Specifications and Features

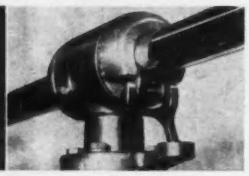
- Group operated, double break air switch, 3 insulator stacks per pole
- Horizontal blade movement actuated by rotation of center stack
- Voltage ratings of 115, 138 and 161 KV in ampere ratings of 600, 1200, 1600 and 2000 amps.
- One piece blade of hard drawn copper tubing
- Only 2 current interchange points
- High pressure silver to silver contacts with coined silver overlay on stationary contacts
- Rotating stack bearing—stainless steel ball bearings completely weather protected



For full details ask for Bulletin 8-100



Reverse loop configuration at contacts utilizes magnetic effect of increasing current to increase contact pressure.



Blade actuating mechanism is simple, powerful and weatherproof, with corrosion resistant bearings.

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make your own scale model "SMRT"

New ALLIS-CHALMERS SURFACE-MOUNTED RESIDENTIAL TRANSFORMER

fully compartmentalized for safety!

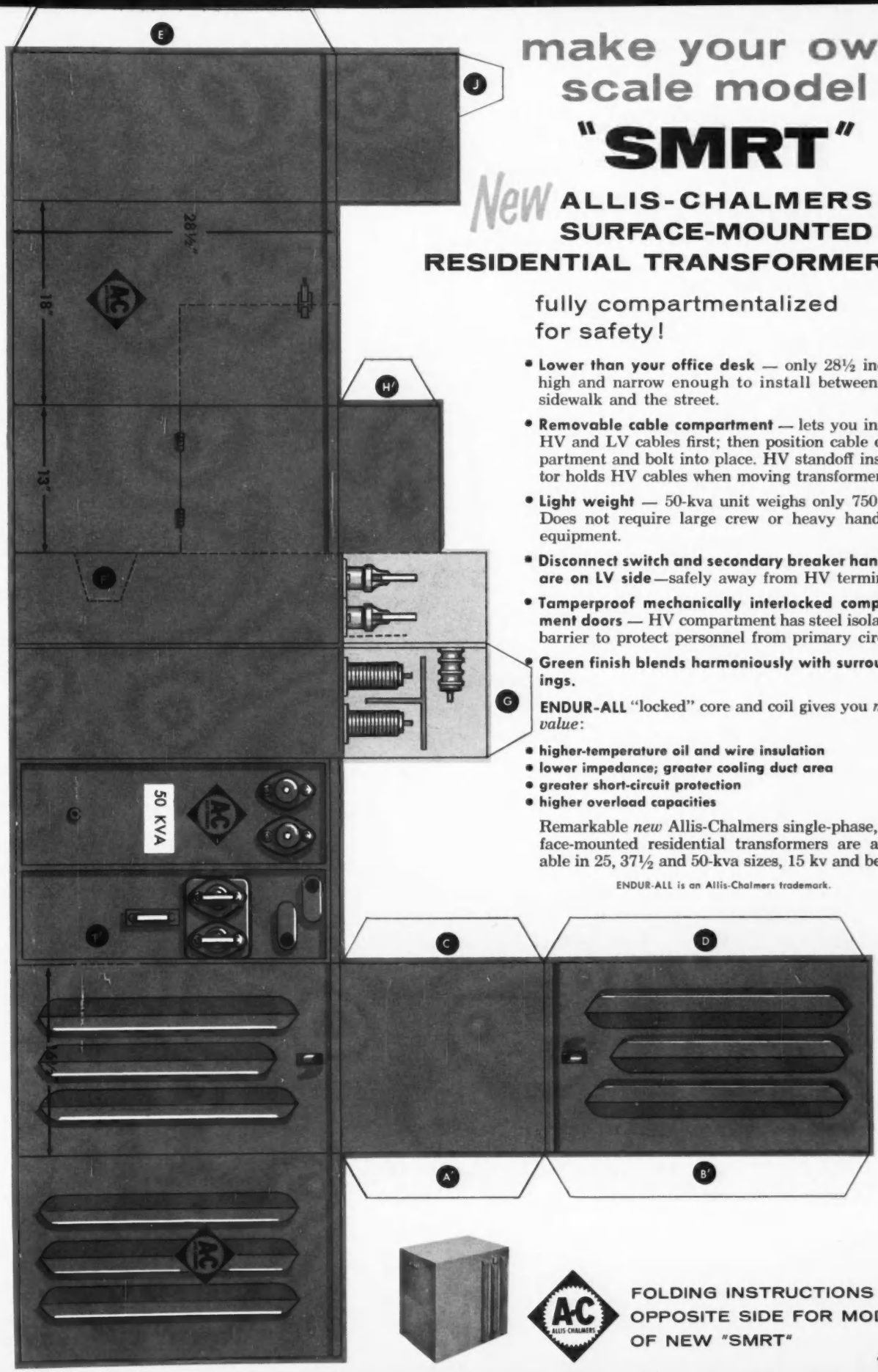
- **Lower than your office desk** — only 28½ inches high and narrow enough to install between the sidewalk and the street.
- **Removable cable compartment** — lets you install HV and LV cables first; then position cable compartment and bolt into place. HV standoff insulator holds HV cables when moving transformer.
- **Light weight** — 50-kva unit weighs only 750 lbs. Does not require large crew or heavy handling equipment.
- **Disconnect switch and secondary breaker handles are on LV side**—safely away from HV terminals.
- **Tamperproof mechanically interlocked compartment doors** — HV compartment has steel isolation barrier to protect personnel from primary circuit.
- **Green finish blends harmoniously with surroundings.**

ENDUR-ALL "locked" core and coil gives you *more value*:

- **higher-temperature oil and wire insulation**
- **lower impedance; greater cooling duct area**
- **greater short-circuit protection**
- **higher overload capacities**

Remarkable *new* Allis-Chalmers single-phase, surface-mounted residential transformers are available in 25, 37½ and 50-kva sizes, 15 kv and below.

ENDUR-ALL is an Allis-Chalmers trademark.

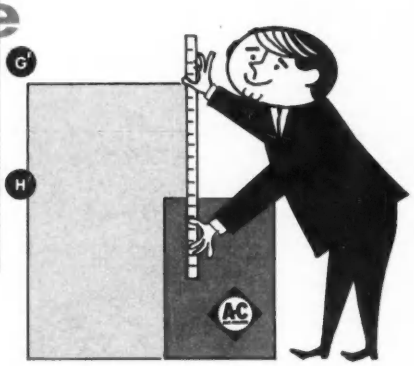


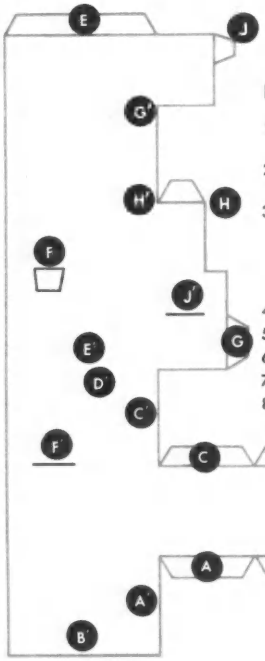
FOLDING INSTRUCTIONS ON OPPOSITE SIDE FOR MODEL OF NEW "SMRT"

A-1528

COMPARE SUPER-COMPACT ALLIS-CHALMERS SURFACE-MOUNTED RESIDENTIAL TRANSFORMERS WITH ALL OTHERS!

"SMRT" is less than ¼ the size of the average of six other makes





FOLDING INSTRUCTIONS

1. Punch out model along perforated edge.
2. Crease down along all scored edges.
3. Fold part containing tabs A B C D over so that they are opposite marked positions A′ B′ C′ D′ and glue in place to form transformer housing.
4. Insert tab F in slot F′.
5. Fold and glue tab G to G′.
6. Fold and glue tab E to E′.
7. Fold and glue tab H to H′.
8. Insert tab J into J′.

Check the chart below! It introduces you to new dimensions in surface-mounted residential transformers. Example: the A-C 50-kva "SMRT" is just 28½ inches high, 29 inches deep and 18 inches wide! That's just 15,660 cubic inches of cabinet compared to competitive cabinets as large as 83,927 cubic inches. Smaller size means easier shipping and handling. Foundation, labor and equipment costs are lower.

Dimensions of A-C 50-kva Surface-Mounted Residential Transformers "SMRT" compared with six other makes

Make	A-C	Brand A	Brand B	Brand C	Brand D	Brand E	Brand F
Height	28½	41	46	43	38¼	38½	42
Depth	29	34	44½	48½	40	45	49
Width	18	36	41	40	37	40	36
Cubage	15,660	50,184	83,927	83,420	56,610	69,300	74,088
% larger than A-C	—	220%	440%	430%	260%	340%	370%

Weights of competitive units are correspondingly greater.

Write, wire or phone your nearby A-C office for more surface-mounted residential transformer facts or copies of Ad A-1528. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

Pacing Power Progress

Editorial Comment

OCTOBER 9, 1961

Interconnection—Key to Million-Kilowatt Units

Coming when it does, Consolidated Edison Co's decision to add a one-million-kilowatt unit points up the significance of the industry's recently announced $8-billion expansion program for transmission lines and interconnections.

Without the existing and projected major interconnections that will cement Con Edison's system with other major power systems to the north, northeast and west, the company's decision to install such a large unit now would not have been feasible. With these interconnections, however, Con Edison can take advantage of the investment and operating economies of such a large unit with the assurance that interconnected companies with different load characteristics can absorb initial surplus power . . . and do it economically.

Still this wasn't an easy decision for Con Edison management. In the past they have installed units ranging from 8 to 10% of their estimated peak load. The new unit is much larger, and now sized for the estimated peak of the interconnected system of which it will be part. But, being the first of its size, more spinning and cold reserve will be necessary to meet unscheduled outages.

The timing of the unit was a tough decision too. Certainly Con Edison faced the purchase of a 1,000-Mw unit some day. But it takes courage to name the date and back it to the tune of $131,000,000.

Con Edison engineers and executives have not only exercised good judgment but courage, foresight and leadership in taking this step.

Upper Colorado Lines: Cooperation or Domination?

Is the Interior Department sincere in its announced intention of cooperating with business enterprise in the development and distribution of electric power? Or is the occasional reference to "cooperation" a mere tactical device for fostering federal encroachment in the power field?

The way Interior goes about allocating funds for construction of a transmission network in the Upper Colorado basin will provide answers to both questions.

The five investor-owned companies servicing in the area have proposed a cooperative investor utility-federal plan for building the necessary transmission network for interconnecting systems and wheeling power from federal hydroelectric projects to preference customers. Under this proposal, the companies would furnish the funds and build about $136-million worth of the proposed network. Interior would build a $50-million backbone line tying together the hydroelectric plants.

Interior has endorsed an all-federal network.

Congress this year provided about $8 million to be used for the backbone tie lines between federal plants and also provided nearly $5 million for the initiation of construction on the network lines which the utilities have offered to build. However, key members of the Senate Appropriations Committee have urged Interior to negotiate with the investor utilities to see if a cooperative plan can be worked out that would save the $5-million federal expenditure immediately, and a total of $136 million.

The investor utilities contend that Interior has never sat down for serious negotiations on their Upper Colorado transmission proposals. These utilities say that they will continue to urge adoption of their cooperative plan either on a joint basis or as individual companies.

Interior Secretary Stewart Udall has the choice of seeking to negotiate an agreement with the investor utilities, as the key Senators have suggested, or of allocating the $5 million for building the contested lines.

It will be up to Udall to show whether he is using the word "cooperation" as a policy objective or as a catchword.

Public Works Appropriation Raps Bonneville's Knuckles

The recently publicized restriction which the Senate Appropriations Committee placed—or tried to place—on funds to build the Upper Colorado Project's transmission lines was not the only instance of such a limitation to be placed on the Interior Department's spending in this year's (fiscal 1962) Public Works Appropriations Bill.

• The House Appropriations Committee rapped the knuckles of Bonneville Power Administration for signing contracts to supply power to industrial customers prior to the time that Congress had approved enough money to assure construction of the transmission lines needed to supply the power—either forcing Congress to appropriate the money, or place the federal government in financial liability for failure to perform.

• The Senate Appropriations Committee, at the urging of Sen Warren Magnuson (D-Wash.), recommended that no money be given to the Bureau of Reclamation to build an intertie between Bonneville and the Bureau's Central Valley Project, Calif., until "necessary legislation" is enacted to provide "adequate legal safeguards" for Pacific Northwest power customers.

In both these instances, the Interior Department is expected to consider and abide by the recommendations. Both recommendations are similar in weight to the original Senate committee's directive to delay construction of the Upper Colorado Project transmission lines for five months, while further negotiations could take place. But, unlike the Colorado recommendation, neither of these two were subsequently watered down in a Senate-House conference report.

The House committee report hits Bonneville's industrial contracts for not, in some instances, carrying a "subject to availability of appropriation" clause. Said the committee, "In some cases, such contracts have been made before the financing of the new private industry to be served has been fully secured. A firm contract for sale and delivery of power, under such circumstances, is a commitment of the federal government in advance of appropriations for implementing it, and to take any other action than to follow later with appropriations for the necessary construction of transmission lines creates a liability on the part of the federal government from a legal standpoint. . ."

"While there may be some valid arguments for drawing such tight contracts in periods when the production of materials for certain industries is a matter of national defense," said the committee, "it is not believed appropriate that such contracts should be the security for loans or financial transactions for the construction of industry facilities."

Bonneville Administrator Charles Luce said he would consult with Interior Secretary Stewart Udall on the use of such contract provisions, but he added that "very serious problems might occur, if Bonneville were to halt the practice. . . . We have always exercised great prudence in such contracts, to avoid obligating Congress to large and needless expenditures."

The House committee also hit Bonneville's practice of signing sales contracts containing "liberal clauses with respect to assignees," and it asked Luce to consider changes here also, before the fiscal 1963 money bill is considered. On this issue, the committee specifically directed Bonneville to spend no money on transmission lines to the Webb & Knapp, Anaconda steel mill, Ida., "until the power purchaser or any further contract assignee has provided specific evidence, satisfactory to the administrator, of his financial security and that he will proceed with construction of the plant contemplated."

The proposed Bonneville-California intertie was the subject of a directive by the Senate Appropriations Committee, largely insisted upon by Magnuson, to prevent any part of the Bureau's Trinity transmission lines—which got initial construction money in this year's appropriations bill—from being used as any part of the intertie. "No appropriation for an intertie should be made until the task force has completed its study and until and unless the necessary legislation is enacted."

The "necessary legislation" refers to some act to give the Pacific Northwest first call on its own power over preference customers that might have access to it, over an intertie, outside the traditional Bonneville service area.

The Senate committee pointed out that "It is not the desire of the committee, in any way, to prevent or hinder the surveys, designs, planning or construction of 230-kv lines to transmit Trinity power" into the Central Valley system. Also, the Senate directive doesn't apply to a $300,000 study of proposed federal interties, also included in the big money bill.

Canadians Hear Forecast Of Giant Western Grid

Canada's second National Northern Development Conference heard a prediction of a giant power grid which may, some day, link the nation's western provinces and territories.

Jack D. Stevens, consulting engineer of the firm of Stevens & Conkling, Seattle, visualized the "vast benefits that would accrue to a pool operation embracing all the major utilities in western Canada

"Extra-high-voltage transmission lines could be constructed from Vancouver east through the provinces," Stevens told the audience. "I have thought that it might be more effective, and also the initial costs might be reduced, if some of the transmission requirements were shifted to utilities south of the border," he added.

"For example, resources of British Columbia could be coordinated with those of the US Northwest utilities and power could move east from the Seattle area to northern Montana. From Montana, power could be interchanged north and south with the Alberta utilities. This would coordinate British Columbia and Alberta.

Again, the loop could continue eastward from Montana to North Dakota and north to interconnections with the Manitoba utilities.

Upper Colorado Dispute Still Simmering

Language of the Public Works Appropriation Bill has done little to solve the controversy over Upper Colorado transmission lines.

Public power advocates interpret the wording of the bill as a Congressional mandate to go ahead with a federal backbone transmission system in the Upper Colorado states. But investor-owned utilities in the area feel that the Bureau of Reclamation has the obligation to negotiate with the companies before deciding to start construction on the controversial lines.

Reclamation Commissioner Floyd Dominy discussed the controversy as a closed book.

But presidents of the investor-owned companies quoted the conference report, as providing funds for the contested lines: ". . . unless the Secretary of the Interior finds it practical and in the national interest to enter into wheeling agreements," and interpreted this to mean that the door is still open for the companies to build the disputed lines.

Much of the difficulty centers around what the Congress meant in allowing the Bureau to begin work on the "backbone system." Secretary Udall announced that his department would "implement the decision of the Congress and proceed forthwith to construct the basic backbone transmission lines needed to market Colorado River Storage Project power" (EW, Oct. 2, p 62). He further said that "we will carry out the recommendation of the Congress and conduct negotiations with all power suppliers in the area with respect to interconnections and wheeling agreements—beyond the basic backbone system . . ."

But does the basic backbone system which Udall feels Congress has told him to build include the controversial lines? Dominy's reference to the controversy as a closed issue implies that this is the case. But the investor-owned utilities take a different view. Presidents of the companies told *Electrical World* that, " 'Backbone system' means the non-controversial lines that will integrate the federal plants in this project. We are not negotiating on these lines since it is our understanding that Congress, in its authorizing Act of 1956, clearly stated that these integrated lines were to be federally built."

"Congressional action," said the investor-owned companies, "did not give the Bureau a mandate to proceed with the all federal system. Congress left a strong obligation with the Interior and the Bureau to work out a decision clearly in our favor. We are still optimistic that the ultimate outcome will be in favor of a combination plan," the president said.

BPA to Test Experimental 460-500-Kv Conductor

Bonneville Power Administration is putting the finishing touches on an experimental 460-500-kv conductor, the first of its kind west of the Rockies. Until now, the highest transmission in the region was 345 kv.

BPA Administrator Charles F. Luce said the line tests will open the way for an eventual transmission voltage of 500 kv on the Pacific Northwest federal grid.

Two 4,000-ft sections of aluminum conductor, over two in. in dia, are being installed near Sandy, Ore., in BPA's 80-mile Big Eddy-McLoughlin 345-kv transmission line. Expanded conductors are used that have open spaces within the conductor to increase the overall diameter. Enlarged outer diameter cuts corona loss.

BPA's test program on the 4,000-ft sections will explore manufacturing feasibility of large conductors of expanded design, and stability under field handling conditions. The tests will also provide field trials for new tools and accessories required for the large, heavier conductor, and obtain operating experience on creep and vibration characteristics under varied load and weather conditions. Supplemental laboratory tests on vibration and creep are scheduled.

"Feasibility studies are now under way to determine advantages of using 500-kv transmission to carry power from John Day dam, with initial generation scheduled for 1967-68, to coastal load centers," said Luce.

Luce added that Pacific Northwest transmission requirements increase at the rate of about 1,000 Mw annually and require new rights-of-way of about 10,000 acres a year with 230-kv transmission. Where 500-kv transmission is feasible, rights-of-way requirements would be greatly reduced.

EACH 8-FT REEL holds 4,000 ft of the 2-in.-dia aluminum conductor. Truck-mounted winch is used in stringing

UPPER COLORADO TRANSMISSION is the topic—Keith Millen, Public Service Co of Colo, right, and Al Tudor, Arizona Public Service, (second from left) talk about their experiences in Wash. with Tom Joyce (left) and Paul Van der Meer

MILTON KAPP, Ed Hebel and Charles Parker in a woodshed session

FROM LEFT: Seated are Don Underwood, Ed Hebel and Tom Jordan. Standing are John Kerr (chairman) and Bill Merrifield, West Penn Power

PIP Group:

Soul-searching by electric utility presidents and public relations executives brought out more questions than answers at the Public Information Program Workshop Conference in Denver, but the self-examination was sincere and objective.

Big question of the moment: "How much political influence do we really have in Washington?" With the heady success of the defeat of Hanford generation just a few weeks old, and with still a chance of winning the Upper Colorado transmission battle (at the time of the meeting) in the minds of virtually everyone attending, the group could easily have been led down the garden path of self-satisfaction or complacency. Such was not the case. Consensus of the speakers was that electric utilities have hardly any political influence, and most of the questions raised were concerned with how to get this influence.

Expression of the problems initially was by Milton L. Kapp, president of Interstate Power Co, who candidly stated: "A small group in Washington is out-producing us." It is his feeling that electric companies are not making the best use of their personnel as public relations ambassadors—and he included top executives as well as the rank-and-file employees.

Information Programs Not Enough

Kapp said too many companies are dutifully joining all the available industry public relations and information programs under the mistaken impression that this will take care of all the problems. It is his opinion that this is not enough—that dedicated, educated employees and stockholders are needed to develop real influence.

He also challenged the timing of electric utility action on things of political importance, i. e., "We wait until we get into trouble, which is too late."

Kapp advised that utilities should take an interest and voice opinions in things dealing with free enterprise in general, that they should provide verbal endorsement of votes and actions taken by those in government who support free enterprise, and that they should achieve a

'How Do We Rate in Washington?'

closer association with Congressmen, and arm them with information—" . . . not just call up and ask for a vote because you are president of such-and-such a utility."

Robert T. Person, president of Public Service Co of Colorado, who was fresh from the Upper Colorado River transmission battle, took the rostrum to say that he is convinced that no electric utility problems ". . . will be solved with a change of administration, except to the extent that we convince the people that what we want is for the good of the community."

Both Parties Are Important

With the experience behind him of having Sen John L. McClellan (D-Ark.) suddenly endorse investor-utility construction of some Upper Colorado lines, Person was able to say with conviction, "Our destiny does not lie with any particular party."

Person emphasized the importance of electric utilities building an image that represents votes to the politicians. "When they look at us," he said, "they must see votes—our employees' and our stockholders'. Then we will have the political stature that we deserve."

The effect of government competition on electric utility earnings and financing ability was explored by Albert Cree, chairman of the board of Central Vermont Public Service Co. He said there is a tendency for electric utilities to take for granted their ability to attract capital, but warned that this is not a safe way of looking at things. "Whatever threatens the future earning power," he said, "is a threat to borrowing ability. Growing federal power is such a threat."

Cree said the ability of the government to take power to the people at lower prices depends on its police power to take money from those same citizens. "We must find a means of carrying this information to all of the people to show them they are being used."

In order to impress people effectively, Cree said the utilities would have to show them how government competition hits them (the people) in their pocketbooks. And to be on secure ground as they carry the message, utilities must be certain they have shunned all special privileges that might be available to them.

An optimistic note was sounded by Edmond W. Hebel, vice chairman of Public Service Co of Indiana, who said the New Frontier was providing the electric companies the best opportunity they have ever had just because of the Kennedy Administration's extremist attitude. He felt confident that the movement of control of their utility service from local sources to the federal government would be stopped by citizens, providing their service has been good, and they are appraised of what is taking place.

Hebel said even cooperative members are beginning to be concerned about the movement of control from themselves to Washington.

An interesting question from the floor was, "Should we take a stand on political matters and encourage employees and stockholders to vote accordingly?"

The answer, stated directly by one speaker and endorsed indirectly in other parts of the program, seemed to be "No." The feeling is that companies should educate employees and stockholders on the issues, and encourage participation and stimulate interest, but should not demand votes in a specified direction.

Interconnection Plans Praised

An unscheduled sidelight to the PIP Workshop came in the form of conversations about the recently-announced interconnection plans of investor-owned utilities.

There is little question, from the tone of cocktail hour conversations, that there is a re-vitalized feeling of unity and purpose on the part of the public relations men that stems from the interconnection plan. The feeling seems to be that electric utilities are now in a positive position rather than on the defensive, and for PR men this is a refreshing outlook.

One man said: "It seems to me we have the strongest arguments against the growth of federal power that we have had since I have been in the business (more than 20 years). We can point to the map and say 'We already have plans to do the job.'"

Thomas M. Joyce, general counsel of Massachusetts Electric & Gas Assn, drew a hearty response from the delegates when he forcefully called for more prestige for public relations personnel from utility management. "Until top brass gives more than lip service to public relations," he declared, "there will be no effective public relations."

Joyce continued: "You have all the guns in the arsenal—and no troops. You have all the tools—but the top brass makes second class citizens out of the PR people. Presidents are late to realize that public and government contacts effect about 75% of the business."

Make All Employees PR Men

Here, again, the recommendation was that companies should start by making public relations representatives of all employees with education, and then proceed to inform stockholders of the issues and how they affect their interests.

Bozell & Jacobs, Inc, the advertising and public relations agency that helped organize and which administers the Public Information Program, staged a dramatic 40-minute visual presentation on the program's history, accomplishments and aims. Written and produced by the B&J staff under the direction of Don Underwood, executive vice president, the presentation detailed the founding of PIP in 1949 and traced its growth to today's 74-company membership. B&J plans to put the presentation on film for the companies' use.

One of the highlights of the two-day workshop was a two-part presentation, "Selling the Value of the Service Pitch," which was aimed at helping companies handle one of their increasingly frequent PR headaches — the large bill complaint. John Dierdorff of Pacific Power & Light Co and Jim McCollum, Pacific Gas & Electric Co, presented the two parts of the program. Based on a PIP survey of some 49 companies, the presentation catalogues the various internal and external actions a company can take to minimize the large bill complaint.

Weather Dominates Summer Peaks:

Company	1961 Summer Peak Load Mw	Increase Over 1960 Summer Peak Mw	Increase Over 1960 Summer Peak %	% Over Predicted Summer Peak	% Over 1960-1961 Winter Peak
Alabama Power Co	2,016	114.6	6.0	−4.7	16.0
Allegheny Power System	1,732	112.0	6.9	−0.5	− 7.6
American Electric Power System	4,888	313.0	6.8	−1.7	0.2
Arizona Public Service Co	681.1	34.0	5.2	−1.2	13.7
Arkansas Power & Light Co	921	−20.0	−2.1	−4.6	26.2
Atlantic City Electric Co	375.7	26.1	7.5	1.5	20.6
Baltimore Gas & Electric Co	1,209	136.0	12.7	5.7	19.1
Boston Edison Co	974	61.5	6.7	3.0	− 1.7
California Electric Power Co	327.9	30.2	10.1	0.0	28.1
Carolina Power & Light Co	1,338	101.0	8.2	−2.3	5.7
Central Hudson Gas & Electric Corp	233.7	6.3	2.7	−1.8	− 3.0
Central Maine Power Co	389.9	13.8	3.6	−2.3	− 2.2
Central Vermont Public Service Corp	111.3	7.5	7.2	0.9	− 0.9
Cleveland Electric Illuminating Co	1,493	60.0	4.2	0.5	8.0
Commonwealth Edison Co	4,840	250.0	5.4	−1.4	8.0
Connecticut Light & Power Co	697.3	49.5	7.6	0.2	− 7.7
Consolidated Edison Co of N. Y., Inc	4,744	392.0	9.0	1.5	16.5
Consumers Power Co	1,825	75.2	4.3	−2.7	− 2.7
Delaware Power & Light Co	473.2	37.2	8.5	−4.8	18.7
Detroit Edison Co	2,740	89.0	3.4	.....	− 2.1
Duke Power Co	2,836.9	175.5	6.6	−1.3	7.3
Duquesne Light Co	1,198.8	61.9	5.4	3.3	6.5
Florida Power & Light Co	1,521	183.0	13.7	−1.9	− 7.9
Florida Power Corp	616	58.0	10.4	−6.9	−18.5
General Public Utilities System	1,998.6	92.6	4.9	1.7	0.9
Georgia Power Co	2,673.2	223.4	9.1	−2.2	14.8
Hartford Electric Light Co	364.9	29.3	8.7	2.4	0.6
Houston Lighting & Power Co	1,957.3	26.1	1.4	−6.1	55.9
Idaho Power Co	711	97.0	15.8	6.1	34.9
Indianapolis Power & Light Co	629	35.0	5.9	−2.8	13.7
Iowa Power & Light Co	339.4	17.4	5.4	−1.1	17.7
Kansas City Power & Light Co	740.3	−4.9	−0.7	−9.7	32.1
Kansas Gas & Electric Co	550	28.0	5.4	−2.8	28.5
Long Island Lighting Co	1,032.8	159.6	18.3	7.0	− 0.1
Los Angeles Dept of Water & Power	1,632	70.0	4.5	−4.6	2.0
Louisiana Power & Light Co	568	26.0	4.8	−2.1	40.9
Mississippi Power & Light Co	499	17.0	3.5	−4.0	37.8
Mississippi Power Co	344	15.6	4.8	−6.9	44.5
Montana Power Co	501	8.0	1.6	1.8	−11.2
New England Electric System	1,324	88.0	7.1	1.4	− 7.0
New Orleans Public Service Co	434	−1.0	−0.2	−4.6	65.7
New York State Electric & Gas Corp	745.9	39.7	5.6	1.3	− 7.6
Niagara Mohawk Power Corp	2,791	195.0	7.5	0.7	− 4.4
Northern States Power Co	1,414.8	67.0	5.0	−0.2	− 2.6
Ohio Edison System	1,742.8	128.5	8.0	2.3	3.4
Oklahoma Gas & Electric Co	902.1	55.5	6.6	−11.6	52.6
Pacific Gas & Electric Co	5,371.9	241.9	4.7	0.1	12.7
Pacific Power & Light Co	1,194	−1.0	−0.1	−6.4	−17.8
Pennsylvania Power & Light Co	1,425	51.0	3.7	1.4	4.9
Philadelphia Electric Co	2,826	198.0	7.5	3.1	17.3
Portland General Electric Co	729	32.0	4.6	−7.5	−22.4
Potomac Electric Power Co	1,288	92.0	7.7	−1.3	50.6
Public Service Co of Colorado	629.2	26.4	4.4	−2.9	− 7.1
Public Service Co of New Hampshire	316.1	19.0	6.5	0.0	− 3.1
Public Service Co of New Mexico	204.6	6.3	3.2	−5.7	1.5
Public Service Electric & Gas Co	3,128	331.0	11.8	4.6	21.0
Puget Sound Power & Light Co	517.2	11.2	2.2	−9.9	−25.4
City of Seattle Dept of Lighting	739	47.0	6.8	.....	−16.0
South Carolina Electric & Gas Co	684	43.0	6.3	0.6	17.7
Southern California Edison Co	3,572	140.0	4.2	1.8	5.0
Southwestern Public Service Co	806.2	39.4	5.1	−3.4	25.9
Tennessee Valley Authority	8,126	185.0	2.3	−2.8	−20.3
Union Electric Co	1,923	63.0	3.4	−1.9	23.7
Utah Power & Light Co	709.3	48.0	7.3	−1.1	6.6
Virginia Electric & Power Co	1,925	153.0	8.6	−2.8	9.4
Washington Water Power Co	527	49.0	10.3	−2.0	−11.7
Western Massachusetts Electric Co	302.6	8.3	2.8	2.6	− 0.8
Wisconsin Electric Power Co	1,217.4	58.3	5.0	0.9	4.4

Summer is inexorably becoming the peaking season for the majority of utilities in the US. Reports from 68 companies in *Electrical World's* annual summer peak load survey showed 44, or 65%, had a summer peak higher than that reported for the previous winter. Many of these are presently in a situation where summer and winter peaks are leapfrogging each other, but many who had previously been in this position are now full-fledged summer peak systems.

In most sections of the country, peak loads were mildly disappointing. Only 40% of the companies equalled or bettered pre-season estimates. Most of these were in the Northeast, where a sizzling early September pushed peaks well above estimates.

But other sections of the country, plagued by (or perhaps favored with) cool weather this summer, found peaks as much as 11% below those expected. This represents a 180-deg phase shift from the 1960 survey, when Northeast utilities were well below estimates and the rest of the nation held up normally.

Trend Is Accelerating

The most interesting result of the survey, however, is the accelerating trend of summer peaks, as distinguished from the historical winter peak season of the past. No less than 14 of the 44 who reported summer peaks higher than those of the previous winter consider themselves winter peaking utilities, but a glance at previous surveys shows that this is a transition period which usually passes in three to five years, after which summer peaking periods prevail.

And the northward march of air conditioning load produced a summer peak above last winter's in both Connecticut and Wisconsin—always winter peak areas.

A total of 33 utilities commented on the weather, pointing up the increasing dependency of peaks upon temperature in most sections of the country. Significantly, only two utilities noted that conditions of sunless skies accompanied the hot weather, showing that the historic lighting load topping off system

Hot in Northeast, Cool Elsewhere

peaks is becoming less significant.

Adding to the weather factor was a perceptible improvement in industrial load in most sections of the country. Half a dozen utilities in widely scattered locations noted the improvement, and only one company found that it failed to meet expectations. There were three cases where strikes at industrial plants cut into the peak. American Electric Power System, which observed the strong industrial gain, stated that its peak would have been higher except for the General Motors strike.

Over half of the companies reporting said their summer peaks occurred in the first two weeks in September. This is about two weeks later than was the case last year. The most popular day for peaks was Sept. 5, the day after Labor Day when nine companies had peaks. Labor Day culminated a period of extreme hot weather in the Northeast and, of course, coincided with the end of the vacation period.

Only three utilities had peaks in June, and all are in the Northwest. Late July and early August was the peak period for most South Atlantic and South Central companies.

Biggest increases over 1960 peaks were generally recorded in the heat-seared Northeast, but fast-growing Florida and some parts of the Northwest also made impressive showings. The four utilities which had peaks below those of last year all cited cooler weather as the primary reason. In the Southwest, which received much more rain than is normally the case, irrigation pumping was reduced with an attendant reduction in peaks. Arizona Public Service noted that irrigation pumping now can account for as much as 5% of its total peak load.

In many cases the increase of 1961 summer peak over that in 1960 was less than the corresponding percent increase of the previous year, proving, more than anything else, the danger of year-to-year comparisons. The 1959 steel strike and less-than-healthy business activity last year cloud the comparison. But compared with a series of past years this year's survey indicated a pleasant improvement in business conditions coupled with a stronger, continuing trend toward a relationship between weather and peaks.

Pacific Northwest Skeptical of California Tie

Selling surplus Columbia River power to California would be a profitable venture if the Pacific Northwest could be sure of getting the power back when it needs it, probably about 1975.

This appeared to be the concensus at a meeting of the Columbia Interstate Compact Commission.

Best argument for sale of the power is the hope that it would reduce the deficit of the Bonneville Power Administration, estimated by Administrator Charles Luce to reach $15 million this year. Luce pointed out that some $32 million worth of Columbia River power will be unused this year for lack of a market.

Ken Billington, executive secretary of the Washington PUD Association, expressed the fear of Bonneville customers that Bonneville might raise its rates in 1964 unless it can get "back into the black."

Most forceful speaker against export of power over a transmission line requiring an investment of $160 to $200 million, was H. Dewayne Kreager, now a private economic consultant in Seattle after serving as head of the Washington State Department of Economic Development. He estimated the Pacific Northwest would be short of firm power in seven or eight years and would have difficulty in recalling any power it might sell to California. Furthermore, California would use the added power supply to its own advantage in competition for new industries, Kreager said.

Also taking a dim view of the proposed line was Maurice Hatch of the Washington Water Power Co., who estimated the Northwest had "less than a 10% chance" of getting back any of the power. Any exchange of power would result in Northwest hydroelectricity displacing the "cheapest steam power" in California, while steam power returned to the Northwest during hydro shortages would be the "most expensive," he predicted. Hatch recalled the 1952 brownout in the Pacific Northwest, when "the power we purchased from California was the most expensive I've ever seen, at 2¢ a kwhr."

The Washington Water Power executive also expressed concern about the nature of the intertie line.

"The non-federal agencies can't build the line by themselves, without an agreement with the Bonneville Power Administration, which has more than half of the available secondary power," he pointed out. "All the secondary power in the area, federal and non-federal alike, would be required to pay for the line."

Hatch objected to "common carrier" provisions of a proposed federal line which would allow private utilities to use the line "only when Bonneville is not." He also sees difficulty in determining whose secondary power should be sold, since both federal and non-federal agencies have supplies available. Hatch proposed that the Northwest "concentrate on saving its secondary energy to use in conjunction with Canadian storage."

Sol Schultz, manager of H. Zinder & Associates, consulting engineering firm which has studied the proposed intertie for California agencies, spoke as the principal proponent of the line. California's steam generation would enable the Pacific Northwest to firm up 400 Mw of secondary hydro energy "at less cost than Canadian treaty power" during low-water years, he said. Schultz agreed with Billington that the line, paying for itself in 10 years, would be of continued value in coordinating power supplies of the two areas.

Station-Class Arresters to Protect

Valve-type units to replace shield wires on Louisiana P&L 115-kv transmission to cut down annual outages by 12.6

HAROLD L. DELONEY, Assistant Chief Engineer, and
JACK K. DAVEY, System Planning Engineer, Louisiana Power & Light Co, New Orleans, La., and
E. J. ALLEN, Supervisor, Substation Equipment Sales, General Electric Co, Pittsfield, Mass.

Station-class, valve-type lightning arresters will replace overhead ground wires on several Louisiana Power & Light Co 115-kv Mississippi River crossings.

The wires failed to give satisfactory protection to the high crossing towers, adjacent structures, and the long spans. A nine-year study of 115-kv lines, including those with and without crossings, prepared the company for selecting the arresters. It included an economic analysis.

The Sterlington-Red Gum wood-pole H-frame line of normal pole heights and two overhead ground wires, the study showed, had only 1.6 tripouts per 100 miles a year. It has no high towers or long spans. The annual tripout rate was 5.2 to 5.8 per 100 circuit miles on the La Place-Luling-Nine Mile and the Nine Mile-Snake Farm lines. These also are of H-frame construction with two overhead ground wires, except at crossings, where the ground wire is single. This outage rate is 2.75 to 3.0 times that of the Sterlington-Red Gum line.

Instead of an overhead ground wire at the river crossing, the Red Gum-Natchez 115-kv circuit has two overhead ground wires on the wood H-frame structures on both sides of the river. In 1938, the crossing was protected by spill gaps over the insulators. But, in 1951, protector tubes were installed at crossing towers and nearby structures. Thereafter, the tripout rate per 100 miles dropped from 13 to zero.

In 1954 yearly tripouts were 26.1 per 100 miles, and the rate since then has been 25.5 per 100 miles. The company believes that erosion of the protector tubes accounts for the increase.

Operating records of 115-kv lines in the same area with no overhead ground wires or other protection show a yearly average of 40 lightning tripouts per 100 miles. This means that the partially protected river crossings on the Red Gum-Natchez line have an outage rate as high as 65% of that of a H-frame line without protection.

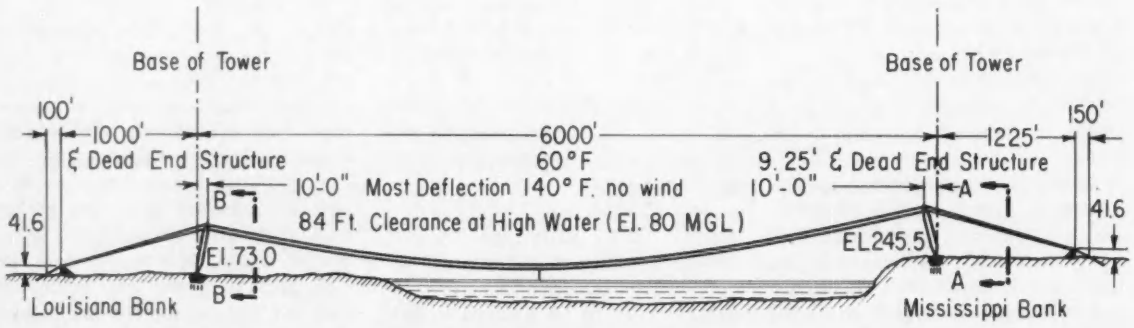
The lightning protection of river crossings is an extension of the so-called high-tower problem. Several methods are in use for river crossings. These may be the same as those on other portions of the connecting line, or special. River crossing protective methods may be summarized, as:

1. No lightning protection yields the lowest initial cost of structures and over-all installation, but carries a frequently intolerable penalty in lightning tripouts. The tripouts may lead to system instability. Plain air gaps and spill gaps are included in this classification because, while preventing insulator damage, they cannot extinguish the power short-circuit arc.

2. Protector tubes without overhead ground wires are an economical means of discharging lightning strokes on unshielded lines, but have a narrow 60-cps current interrupting ability. System capacity additions contribute to the available short-circuit values that push the tubes beyond their ratings. Tube erosion after repeated operations depreciates the protection.

3. Valve-type lightning arresters must have high discharge capacity so that, while protecting the line insulation, they protect themselves from damage by high-current lightning strokes, prolonged discharges, and repeated operations. Like protector tubes, arresters are at the tower top, close to the insulators, and an external air gap in series with them dispenses with mechanical attachment from the line.

4. Overhead ground wires shield conductors and induce surges of the same polarity on the conductors by coupling, thereby reducing the voltage across the insulators. Ground wires offer a surge impedance in both directions from the lightning stroke. The demanding conditions of river crossing towers put one or



PROFILE VIEW of 115-kv river crossing near Natchez, Miss., shows span longer than 6,000 ft suspended from towers, each 405 ft high, on each bank. The long span and high structures will be protected by new arresters

Mississippi Crossings

two overhead ground wires to a real test, electrical and mechanical.

5. Overhead ground wires and lightning arresters, or protector tubes, probably represent the best protection, when economics are disregarded.

Basically, there are five methods of calculating lightning voltages on a line:

1. The AIEE method assumes that the tower-top potential of a struck tower is determined by the voltage drop across the tower footing resistance, plus some induction in the tower. The inductance is essentially the tower self-inductance. This method failed to predict the excessive lightning tripouts on 345-kv lines with 150-ft towers, and on other transmission lines of tall towers.

2. The surge impedance method treats the tower structure as a surge impedance, fixed or variable with time, depending on the desired precision. Although disputed, this method appears to lead often to the correct results.

3. Another method compares the line with one of known lightning performance. A fuller knowledge of the electromagnetic behavior of lines and towers is a prerequisite.

Uses Analog Computer

4. The electromagnetic field approach uses an analog computer and reduced-scale models of lines and towers. It is mathematically useful, but difficulties arise in establishing parameters.

5. The Monte Carlo computer calculation handles large groups of probabilistic and deterministic relationships in lightning flashover processes on transmission lines. To date, lightning outage rates of nine different transmission lines calculated by it compared with actual outage rates. The computer places the relative location of strokes as follows: 60% to the tower; 30% to quarter-span, and 10% to mid-span for metal towers. The tower, having a large mass, attracts more strokes.

Two major obstacles to successful calculations of lightning performances have been these: Incomplete knowledge of the characteristics of lightning contacting an overhead conductor; and, oversimplified concepts of the line's response.

Available information indicates that lightning strokes to high objects increase with the objects' height. The great increase in stroke frequency is due not only to being up in low thunderclouds, but also to the increasing prevalence of upward streamers. The latter initiate direct lightning strokes to those objects. These conclusions are based on studies of objects 600 ft or higher, particularly the Empire State Building, which is 1,250 ft high. But the performance of crossing towers, only a few above 600 ft, remains in question.

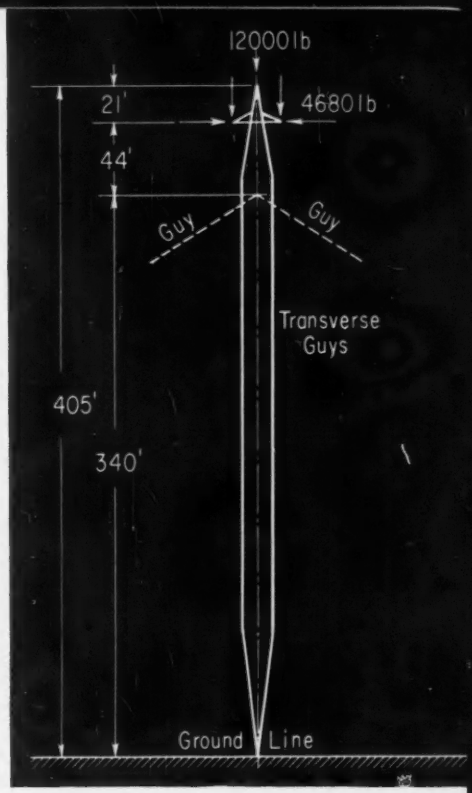
Two approaches fix the strokes per crossing of this type:

1. Based on data of strokes to high objects, an average of 2.4 per year can be expected for 600-ft structures where the isokeraunic level is 30. Strokes become six per year where the isokeraunic level is 75, the level in the Louisiana P&L service area. Using stroke distribution described above, the number of strokes to the different span segments appear in Table III.

2. Based on the number of strokes to the land area shielded by the transmission line, assuming a 30-deg shielding angle, calculations indicate that there are 16.1 strokes per crossing a year. This result, applied to an isokeraunic level of 75, considers a tower on a high bluff and having a considerable mid-span sag.

But when the data of Table III are used and tower-height differences taken into account, the calculated strokes to the same crossing are 17.6 per year. Thus the two methods agree closely.

Lightning strikes a line as often regardless of whether it has one or several overhead ground wires. But the response of the line differs, the response depending on the protective measures taken, whether ground wires, arresters, or other. Calculations show that line flashover and circuit tripout follow about 80% of direct strokes to the span. Only low-current strokes fail to cause tripout. When a crossing is struck 16.8 times a year, the expected line outages are 80% of 16.8, 13.4 per year.

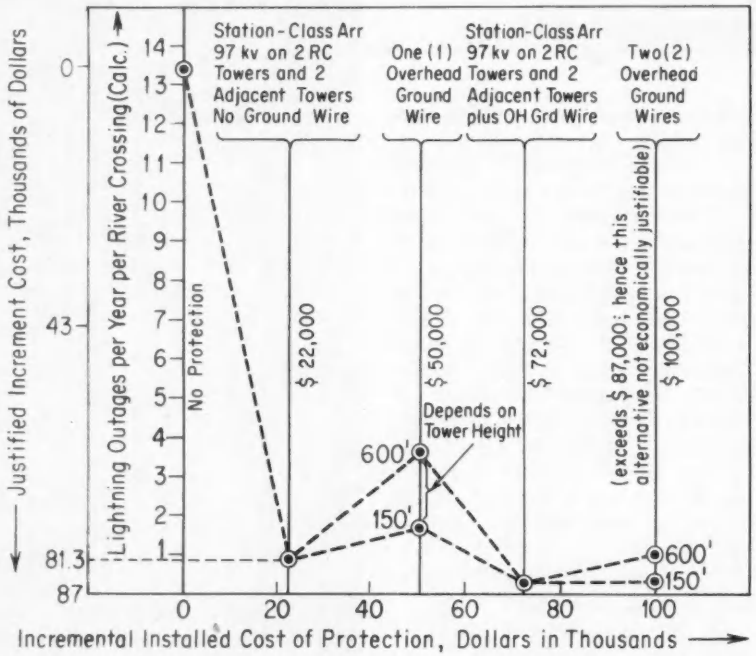


ELEVATION VIEW of tower used at Mississippi 115-kv transmission crossing

When a stroke hits a ground wire at or near a 300-ft crossing tower, all four analyses are in basic agreement, if the ground wires protecting the span are connected to the tower's apex and to structures on both sides of the river—and some refinements are neglected. But if flashover of the insulators is to be avoided, the impulse voltage across the insulators must be limited to less than their flashover voltage during the time the first reflection travels from the tower base to the point of stroke. At a 300-ft tower, this is at least 0.6 μsec. A lightning surge, having a high rate of current rise over a 0.6-μsec interval, flashes over the longest practicable insulator string.

3,400 Kv Developed

Volt-time curves of voltage across insulator strings on towers show that 3,400 kv is developed across 350-ft tower-top insulators within 0.65 μsec, the assumed stroke current of 50,000 amp having a 0.5-μsec front time. This stroke would flash over at least 25 10-in. discs. In these circumstances, the voltage developed across the insulators on a 100-



ECONOMICS of protecting 115-kv river crossings by different methods is compared in graph based on Louisiana P&L's experience over nine-year period

ft tower is 1,800 kv, the lines being insulated for 132 kv withstand.

Ground wires are effective protection for tower heights up to 100 ft. They divert part of the lightning stroke from the tower, the capacitance coupling between them and phase conductors reducing the insulator voltage. Yet, for given parameters, the voltage across the insulator string goes up almost directly with the height of the tower. Stroke current, which does not flash over insulators on a 100-ft tower, probably will flash over the same number of insulators on a higher tower, such as those at river crossings. The reflection time to ground, via the tower, for a stroke to the ground wire at mid-span on a river crossing, is well over 1 μsec. Air clearance between ground wires and phase conductors must withstand the impulse voltage during this time.

The station-class, valve-type lightning arresters, which Louisiana P&L proposes to use, will be installed across the insulator strings. This arrangement eliminates the effect of tower height on line protection. The arresters will provide a coordinated, preferred discharge path to the tower. With efficient arresters of proper rating, the insulators will not flash over, regardless of tower height or ground resistance. The insulators of each phase of each river crossing structure will be shunted by the arresters.

Direct-Stroke Duty High

Station-class arresters have a rather high direct-stroke duty. Nor is their service life affected by the number of discharges, or the amount of short-circuit current available. Crossings, operating at voltages up to 230 kv, can be protected by low-height arresters.

Arresters will be installed also on structures next to the crossing towers. Although these structures are of normal height, the tower-top potential along the line could be high enough to cause flashover, were they not so protected.

The replacement of overhead ground-wire by lightning arresters,

Table I—Operating Experience with 115-kv Transmission Lines with Isokeraunic Level Averaging 75 Thunderstorm-Days per Year

Name of Line	Length Miles	River Crossing	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	9 Year Average
Sterling-Red Gum (Single Circuit)	85.04	None	3.6	2.4	No Data	2.4	2.4	1.2	0	2.35	0	0	1.6
			Two overhead ground wires, wood pole H-frame										
Red Gum-Natchez	14.9	Natchez	13.0	0	——	26.1	32.5	13.5	27	26	33.65	20.18**	
			Protector tubes installed on 2 crossing towers and two adjacent structures in mid-1951. In 1956 and 1958, tubes failed on top phase, and dead-end tower. 2 overhead ground wires on wood H-frame connecting lines except for crossing.										
LaPlace-Luling-Nine Mile (Single Circuit)	27.7*	Taft	4.1	1.8	——	0	14.5	3.6	3.6	0	9.2	9.2	5.2
			2 overhead ground wires on connecting wood-pole H-frame. One overhead ground wire on 3,780-ft crossing span.										
Nine Mile-Snake Farm (Double Circuit Built in 1954)	7.35	Nine Mile-Snake Farm	Circuit #1	0	0	0	0	0	26.9	13.6	0	5.8	
			Circuit #2	0	0	0	0	0	13.6	26.9	0	5.8	
			2 overhead ground wires on connecting wood-pole H-frames, One overhead ground wire on 3,796-ft crossing span.										

*Until 1958, 10.9 miles after 1958
**Nine-year average not significant

Table II—Comparative Lightning Protective Methods for River Crossing Structures (150 to 600 ft or higher)

	Susceptibility to Line Flashover due to Lightning		Effect of Tower Crossing		Pros & Cons
	At Tower Structure	At Mid-Span	Height	Ground Resistance	
(a) No Protection	Susceptible to direct lightning strokes and outage from flashover anywhere along span or at structures		Increasing tower height makes span better target for direct strokes, hence more tripouts	Unimportant, as direct strokes contacting line conductors will flash over any number of unprotected insulators	Lowest cost due to absence of protection but has unacceptable performance
(b) Protective devices at each high tower and on adjacent structure on each side of crossing. (No overhead ground wires)	As arresters are in shunt with insulators on each phase, and coordinated to direct lightning stroke currents, no flashover results	Some residual cases of lightning flashover at mid-span due to direct strokes at or near there	Negligible effect on performance	No effect on performance, due to action of arresters	Next to lowest cost, yet virtually as good performance as case (d) (Best). Optimizes performance at lower cost
(c) Overhead Ground Wire(s)	Moderate susceptibility, depending on No. of ground wires, tower height, etc	Has probably lowest susceptibility to mid-span flashover	Increasing height of tower makes necessary small shielding angle (and 2 ground wires) and even so, high structures are more susceptible to "sneak" strokes	Low ground resistance, while desirable, is of secondary importance	Next to highest cost. Effectiveness depends on number of ground wires, tower height, etc
(d) Protective Devices plus Overhead Ground Wire(s)	Combines advantage of (b) with that of (c)	Combines advantage of (c) with that of (b)	No effect on performance	No effect on performance, due to arresters	Has theoretically the best performance but highest cost

in the design of a river crossing, cuts tower costs; lighter, shorter, and hence lower-cost towers can be specified. The latter are feasible because conductors are fewer, mechanical-strength requirement less. But arresters have this disadvantage: they do not always "reach out" to relieve the impulse voltage at mid-span. But, as only 10% of the strokes are at mid-span and very few of these cause flashover, the disadvantage is not serious.

Ideal Is Combination

The ideal protection is a combination of overhead ground wires and arresters. But the degree of improved line performance does not warrant the additional cost.

A typical 115 or 138-kv woodpole, transmission line in ordinary terrain costs $16,000 per mile with overhead ground wires; $13,500 per mile without them. Hence, such lightning protection costs $2,500 per mile of line. The ground wires improve performance from 40 to 1.5 tripouts per 100 miles per year, *i.e.*, they prevent 38.5 tripouts per 100 miles annually. Elimination of one tripout per year costs $6,500 in capital investment.

The overhead ground wires on lines where the isokeraunic level averages 75 indicate Louisiana P&L's willingness to spend $6,500 to avoid one tripout a year. To eliminate 13.4 outages per river crossing per year on this basis would cost $6,500 times 13.4. This expenditure of $87,000 would have to be justified.

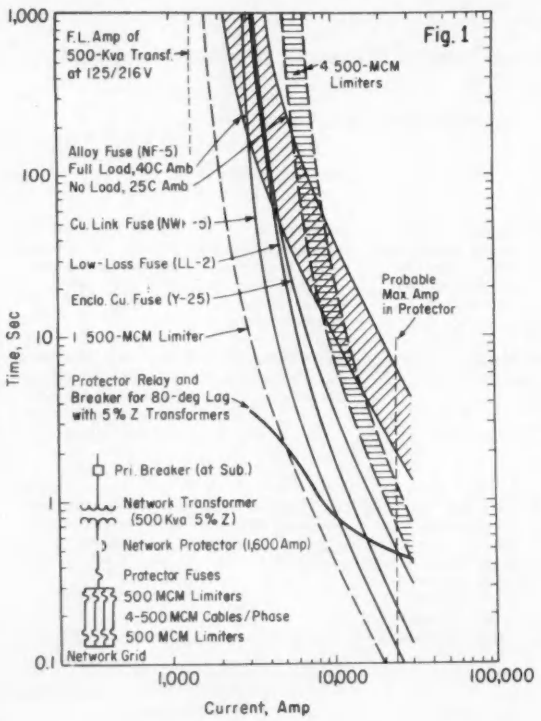
Installation of 97-kv station-class lightning arresters on two crossing and two adjacent dead-end towers will have an incremental cost of $22,000 and an expected annual outage rate of 0.9 per river crossing. This represents a yearly reduction of 12.6 outages per crossing. The capitalized value of this reduction is $81,300, considerably more than the $22,000 cost.

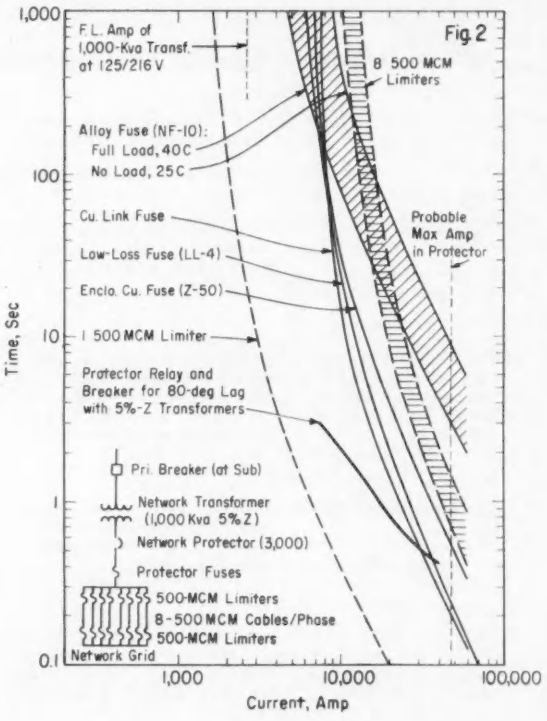
Similarly, alternate although more costly protection methods have been analyzed, the results appearing in the accompanying graph. These include cases (a), (c), and (d) in Table II.

As case (b), involving station-class lightning arresters on two crossings and two adjacent towers, without overhead ground wires, optimizes good lightning performance at relatively low cost, several river crossing will be equipped accordingly, beginning this year.

Table III—Lightning Strokes to Sections of Crossing Span

	Section of Span	Complete Span
Strokes to each of two towers	6	12
Strokes to each quarter-span (2)	3	6
Strokes to mid-span (2)	1	2
Estimated stroke to connecting line span (1 each)	1	2
Total calculated strokes per year to crossing span and connecting spans		22





Protector Fuses Meet Close Limits

Coordination with relays and limiters is exacting, but fuses must also carry normal load and fault currents. Expanding 277/480-v networks stiffen arc-clearing considerations

H. H. LAWSON, Application Engineer, General Electric Co, Philadelphia, Pa.

Application of low-voltage network distribution to 277/480-v systems, coupled with the sharp rise in transformer capacity installed at each unit, call for re-appraisal of the fuses used in each network protector. The re-appraisal must consider the ability of the fuse to coordinate with protector relays and network limiters at the fault-current levels of 277/480-v networks, as well as the tenacity of high-current faults at the higher voltage.

Network protector fuses are provided primarily for backup protection. They should not blow on a network feeder fault before the network relays have time to trip the protector. But as backup, in case the protector fails to open, they must blow in a reasonable time for any probable minimum value of current to a network feeder fault. Yet the fuses must also carry maximum load current of the network transformer with a reasonable margin.

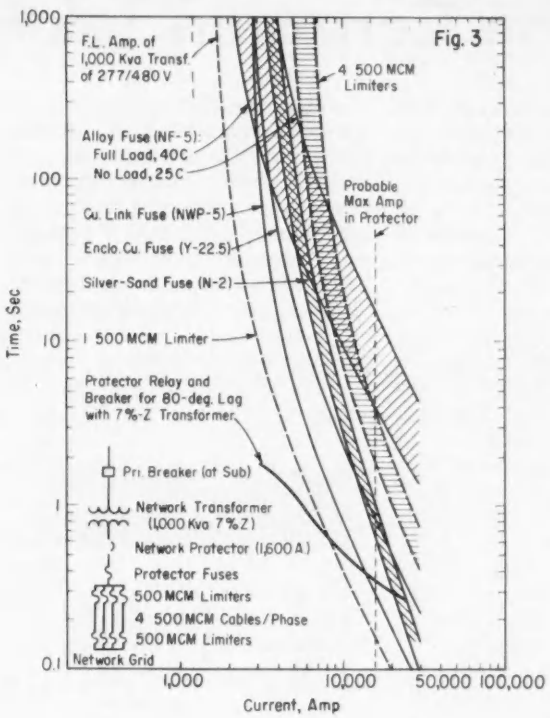
Limiters Limit Fuse Selection

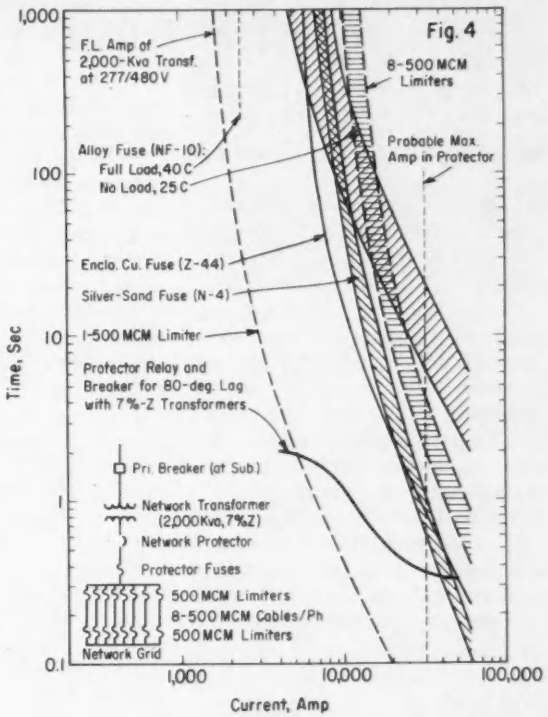
When limiters are used on the network grid cables, they must carry without damage any current to a feeder fault which will be controlled by opening of the network protector or blowing of its fuses. But the limiters on a faulted secondary cable must blow before the fuses in any protector. Otherwise the secondary fault might persist while a number of network units were cut off by a series of protector fuse blowings, possibly to the point where the fault might fail to clear.

Initially network protector fuses were open copper links. Such fuses are still used on many networks, 480-v as well as 208-v. But their steep time-current characteristic requires use of the largest fuse that will blow on minimum primary fault currents to reduce the danger of fuses blowing for a secondary fault. In addition, as shown in Fig 1, such fuses may fail to coordinate with the network protector relays for a heavy reverse current into a network transformer or feeder fault.

Enclosed copper fuses must have a larger cross-section to carry load currents without overheating. Accordingly they blow somewhat slower under heavy fault conditions than open links, thereby gaining substantially better coordination with network protectors for current into transformer and feeder faults. Coordination for this condition is demonstrated by Fig 1 to 4.

Alloy fuses were developed to gain time delay at high currents. This gives additional margin for burning off secondary faults, without sacrificing backup protection for primary feeder faults. These fuses





in Low-Voltage Secondary Networks

are particularly valuable for protection against phase-to-ground faults on feeders of networks with Y-Y-connected network transformers. But their low melting temperature makes them susceptible to faulty blowing during periods of high ambient temperature. And, as illustrated in Fig 1 to 4, co-ordination with limiters for severe secondary faults is impossible.

Low loss fuses depend upon a tin section to operate by molten metal corrosion at 232C for minimum current operation. This principle permits the fuses to be designed for losses approximately half those of conventional fuses, thus enabling the protectors to carry higher contingency loading. Such fuses have somewhat more delay at high currents than copper links, hence coordinate better with network relays for feeder faults. But they cannot be used for 480-v networks.

Silver-sand fuses have come into

(*Continued on page* 71)

General Applications Set Pattern for Protector Fuses

Protector Rating, amp	Network Transformer Kva @ 216 v	Network Transformer Kva @ 480 v	Probable Ratings of Protector Fuses Enclo. Cu	Ag Sand	Cu Link	Alloy	Low-Loss
800	225	.....	Y-11	...	NWP-7	NF-2	.....
	.....	500	Y-11	...	NWP-7	NF-2	Not Appl.
1,200	300	.....	Y-15	...	NWP-6	NF-3	.....
	.....	750	Y-15	...	NWP-6	NF-3	Not Appl.
1,600	500	.....	Y-25	...	NWP-5	NF-5	LL-2
	.....	1,000	Y-22.5	N-2	NWP-5	NF-5	Not Appl.
2,500	750	.....	Z-37.5	...	NWP-3	NF-7	LL-3
	.....	1,500	Z-37.5	...	NWP-3	NF-7	Not Appl.
3,000	1,000	.....	Z-50	...	.....	NF-10	LL-4
	.....	2,000	Z-44	N-4	.....	NF-10	Not Appl.

Condenser-Tube Corrosion Takes

Causes, effects, remedies for copper-alloy tubing

V. F. **NOLE**, Company Corrosion Engineer, Chase Brass & Copper Co, Waterbury, Conn.

Though the choice of copper and and its alloys for water-cooled heat exchangers is due primarily to their corrosion resistance, they may be subject to various types of attack. Condenser-tube copper alloys comprise a wide range of chemical compositions and accordingly vary in resistance to corrosion. This article outlines the various types of corrosion together with some remedial measures that can assist in providing long and trouble-free service.

1. Uniform or general thinning

On a weight-loss basis, general thinning is perhaps the only type of corrosion for which rates of penetration may be estimated with any degree of accuracy. The rate of such corrosion depends on the corroding medium, velocity of flow, temperature and other factors. It is usually due to acid environments, particularly to those containing oxygen or oxidizing agents such as ferric salts, chromates, dichromates, bromates, cholorates, permanganates and iodides.

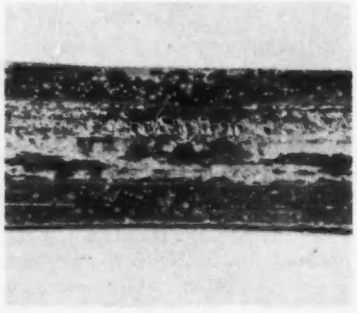
General thinning, which is usually the least serious type of corrosion, also occurs from the solution effects of certain basic compounds that form soluble copper salts. Ammonia and related compounds are the principal ones in this category. Ammonia also gives rise to special effects discussed later.

2. Pitting

• **Sulfur attack**—Pitting is more rapid than general thinning, and localized penetration can occur with little total metal loss. Various degrees of pitting range from deep pits to those so shallow as to approach general thinning. Attack by sulfur-bearing compounds gives rise to the latter.

In general, the resistance of copper alloys to sulfur corrosion increases sharply with a decrease in copper content down to about 85% copper. Alloys containing 85% or more copper are not recommended where sulfur-bearing compounds are being handled.

• **Deposit attack** — In solutions which are quiet or are moving at low velocity, pitting is usually due to local cell action, usually an oxygen-concentration cell. This cell may arise from the presence of various deposits, usually inert, such as sand, shells or corrosion products on a metal surface. If the deposits are nonporous solids, such as shells, the tube does not corrode directly beneath the object but rather in the crevices where the object contacts the tube wall. If semiporous deposits, such as cloth, wood or corrosion products contact the metal, the tube can pit under the deposit.

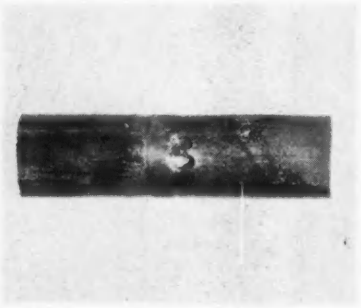


POROUS DEPOSIT causes pitting through local cell action

The deposits shield portions of the metallic surface from oxygen. Films of oxide form over these adjacent areas so that pitting results. The pits tend to be spherical and are said to be the result of deposit attack.

One method of controlling deposit attack is to keep the equipment clean. Entrance of foreign matter should be hindered by baffles or stationary and rotating screens. Periodic cleaning should be done by flushing the system or tubes with high-pressure air or water, cleaning with brushes or rubber plugs and with various chemical solutions. Wire brushing can produce scratches which in time act as focal points of future corrosion attacks.

• **Crevice attack** — Concentration cells formed at crevices can produce differential oxygen concentration because of difficulty of access of oxygen to the crevice. Corrosion takes place in the crevice area of low oxygen concentration (anodic) since an electrochemical cell is set



CREVICE CORROSION occurs under low oxygen concentration in crevice

up between it and the metal more freely exposed to the corrosive medium. The potential danger of crevices has become widely recognized and a great deal of work is being done to eliminate crevices through proper design.

• **Water-line attack**—This is another form that is largely controlled by differential oxygen concentration. The cell functions between the strongly aerated surface layer of the liquid and the less well aerated surface immediately below. The area of lowest oxygen concentration is anodic, hence localized attack takes place just below the surface of the liquid. This type of attack usually occurs in still or slowly moving liquids, not where the depth of the liquid is continually changing.

Water-line attack can be controlled by avoiding stagnant conditions. Cathodic protection and protective coatings have proved beneficial.

• **Impingement**—A very common form of corrosion in steam condenser tubes handling salt and brackish water is impingement attack. It can cause deep pitting, confined usually to the first few inches of tube, but sometimes extending along the entire tube. It is

Many Forms

encountered in water with entrained air or particles such as sand. It occurs under high velocity and with turbulent water so that air bubbles or abrasive particles in the water impinge on the tube, remove the naturally formed surface film and permit electrochemical corrosion to proceed between the freshly exposed portions and the film-covered portions. Destruction of the protective film is also simultaneously caused by the collapse of vacuum bubbles formed in local regions of the low pressure in the same general area of tube.

Pits are elongated in the direction of flow and are undercut on the downstream side. As the attack progresses, there may be found a series of crescent-shape pits with their open ends on the downstream side. A series of pits may merge

IMPINGEMENT by entrained particles makes crescent-shaped pits near inlet

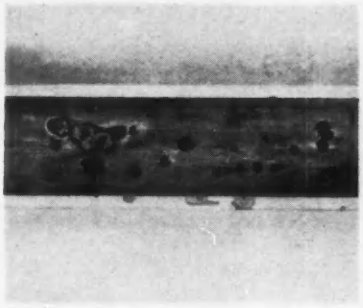
to give a serrated profile across a longitudinal section. Impingement attack can also occur in fresh water at sharp bends or sudden cross-sectional constrictions.

It can be alleviated by governing the amount of entrained gases, reducing fluid velocity, and streamlining the fluid flow. Water intake should be well below the surface of reservoirs to avoid sucking surface air into the system. Valves, bonnets and glands should be airtight. Sharp hairpin bends should be avoided. Water boxes on condensers should be kept clean to maintain design water velocity. It is possible to step up water velocity greatly in condensers by blocking some of the tubes. In some cases where the impingement attack is confined to the first few inches of the inlet end, metal or plastic inserts have considerably lengthened tube life. The most resistant copper base alloys are 70-30 cupro-nickel, 80-20 cupro-nickel, 90-10 cupro-nickel and aluminum-brass in the order listed.

3. Selective solution

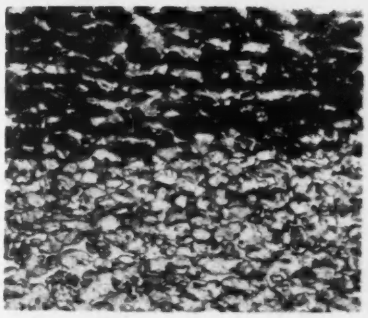
This is attack by which one constituent is preferentially removed. In copper-zinc alloys, those containing more than about 80% copper are more resistant than the yellow brasses to selective attack, which in this case is known as dezincification.

Dezincification of brass may be highly localized. The plugs of dezincified material formed are usually held in place and permit only slight seepage. Frequently plugs are readily located through the brownish-white, zinc-rich salts which form directly over them. When dezincification proceeds by formation of a more or less uniform layer of copper on the entire wall of a pipe or tube, it is known as uniform or layer type dezincification.



LOCAL DEZINCIFICATION of copper-zinc alloy permits slight seepage

In the two-phase alloys (alpha and beta) such as Muntz Metal and Naval Brass, which contain about 60% copper and 39-40% zinc, dezincification first selects the beta phase. If under severe conditions the attack spreads to both the alpha and beta phases, complete dezincification may result with the formation of a layer of porous copper which sometimes can be peeled off. In addition to local and uniform dezincification, the attack may occur preferentially along the grain boundaries.



BETA PHASE is selectively dezincified (dark area) in two-phase alloy (X75)

Dezincification is ordinarily encountered in stagnant or slowly moving solutions. It occurs frequently in non-scale-forming fresh or salt waters with the pH 5 to 8 or higher. The rate of attack generally increases with increasing temperature.

It can be retarded by mechanical or chemical cleaning, keeping the temperature low and increasing the water velocity.

Copper-zinc alloys of more than 80% copper are almost immune to dezincification, as are the Admiralty alloys (copper 70%, zinc 29%, tin 1%) inhibited with small amounts (0.03%) of antimony, arsenic or phosphorus.

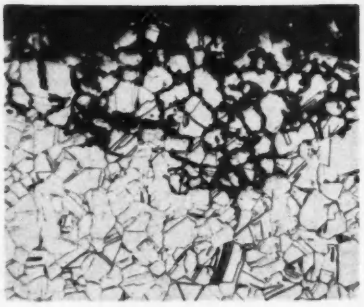
4. Stress corrosion

Stress is an effective accelerant in the premature failure of aluminum alloys, steels, certain copper alloys containing less than 85% copper, and many other metals. This type of failure, usually sudden and with little apparent corrosion, does not occur if either stress or corrosion is absent. In the case of brasses, the corrosive influence is almost invariably ammonia, or ammonia-bearing compounds plus moisture, oxygen and carbon dioxide. The stress may result from service loading.

Stress corrosion failure is readily identified as a ragged crack or cracks, generally perpendicular to the stress direction. The cracking is largely intercrystalline but in some cases a certain amount of transcrystalline cracking can be detected. The cracks start between the grain at the surface and then proceed through or across the grains.

(Continued on next page)

INTERCRYSTALLINE stress corrosion may be due to service loading (X100)



INTERCRYSTALLINE corrosion is usually only a few grains deep (X250)

The susceptibility of cold-worked brass to stress-corrosion cracking can be eliminated by low-temperature annealing near 500F. This treatment, commonly called stress-relief annealing, lowers internal stresses to safe values and, when properly applied, has little or no effect upon hardness.

Certain copper and copper-base alloys are practically immune to stress-corrosion cracking. Commercial coppers such as electrolytic, fire-refined, like tough pitch copper and oxygen-free copper, are in this class. The cupro-nickel alloys (90-10, 80-20 and 70-30) and high-copper alloys containing less than 15% zinc are highly resistant to this type of cracking. As the zinc content of brasses increases from 15% (red brass) to the commercial maximum of 40% (Muntz Metal), the susceptibility to stress-corrosion cracking increases. Some of the more complex copper alloys that are susceptible to the failure are Naval Brass, plain and inhibited types of Admiralty and aluminum brass.

Stress corrosion attack is encountered with other materials, such as aluminum, magnesium and certain types of steel. In the case of other metals, different corrosive agents are influential.

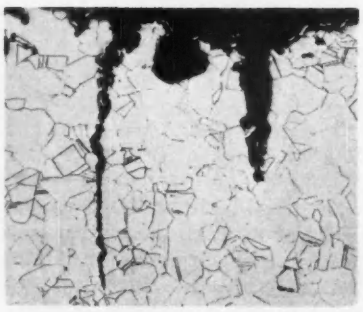
5. Intercrystalline corrosion

One form of corrosion which can take place with little or no apparent metal loss is intercrystalline attack, under which the boundaries of the crystals or grains in the metal are penetrated. This type of attack is often associated with a stress condition of the metal (stress corrosion).

Allied to stress corrosion cracking is still another form of intercrystalline corrosion or solution in which stress is not a factor. Corrosion is usually only a few grains deep. This type of corrosion is favored by only a very few alloy compositions.

6. Corrosion fatigue

Fatigue stresses, induced by vibration, sometimes combine with corrosion to produce corrosion-fatigue failures in a much shorter time than would be expected from fatigue or corrosion alone. The metal surface is roughened by corrosion, thus producing a series of notches, which are stress raisers. The vibrational stresses, which lead to fatigue far below the ultimate strength of the material, become concentrated and raised at the bases of the notches, so that fatigue cracks soon appear. The cracking may proceed rapidly to failure.

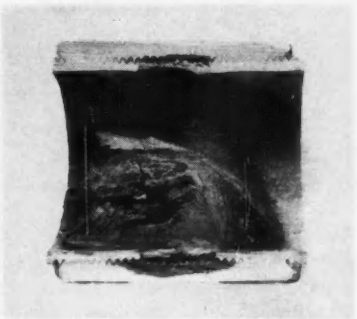


FATIGUE from vibration combines with corrosion to cause cracks (X250)

Controlling the cycle of repetitive stresses in the structure largely controls corrosion fatigue.

7. Galvanic corrosion

Galvanic corrosion occurs when dissimilar metals are in contact with each other in the presence of a suitable electrolyte. The less noble metal is anodic and corrodes faster than it would alone, while the more noble metal is the cathode of the cell and corrodes to a lesser degree than if the galvanic couple had not existed. The effect of cell action is usually very localized and corrosion is confined for the most part within a few inches of the line or area of contact of metals. The rate of corrosion depends among other things upon the nature of the corrosive environment, upon the ratio of cathodic to anodic surface and upon the formation or removal of protective films of the corrosion products. Copper rarely suffers galvanic corrosion because it is cathodic to commonly encountered metals, such as iron, zinc, magnesium, lead and tin. In general, the coupling of different copper-base alloys to one another does not lead to a significant increase in corrosion rate.

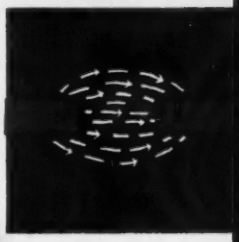


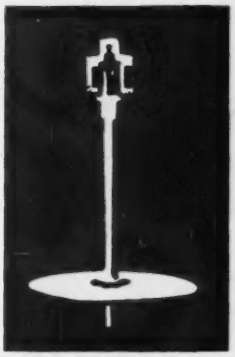
GALVANIC action corrodes the less noble of dissimilar metals in contact

To prevent galvanic corrosion, dissimilar metals should be avoided. If this is impossible, metals should be chosen which are not far apart in the galvanic series. Joints should be completely insulated by non-conducting materials, rubber, fiber, wood or various paint-like materials. The area of the metal lower (cathodic) in the galvanic series should not be much larger than that of the higher (anodic). Combinations in which the area of the metal lower in the series is much smaller than that of the higher metal will not result in significant galvanic corrosion.

Background and history of metering

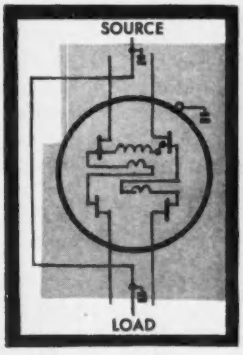
Principles of electricity, magnetism

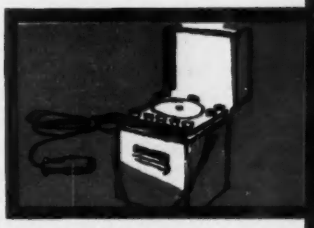




Components and their functions

Application and installation





Testing, inspection and maintenance

ANOTHER GENERAL ELECTRIC METERING EXTRA . . .

Meter courses help utilities train personnel

Two meter courses—one each on single-phase and polyphase designs—are conducted by General Electric at its Somersworth, N. H. plant and utility locations to assist utilities in training their personnel.

Basic information and new metering advances are provided on all single- and polyphase subjects, plus field training on demand meters and registers.

For example, the single-phase course covers five areas: background and history; principles of electricity; components and their functions; how to select and install meters; how to test, inspect and maintain meters. The polyphase meter training course is equally as comprehensive.

Complete courses are available in kit form for inclusion in utility training programs. For more information on how your metering personnel can benefit from these courses, contact your General Electric Sales Engineer. 713-11

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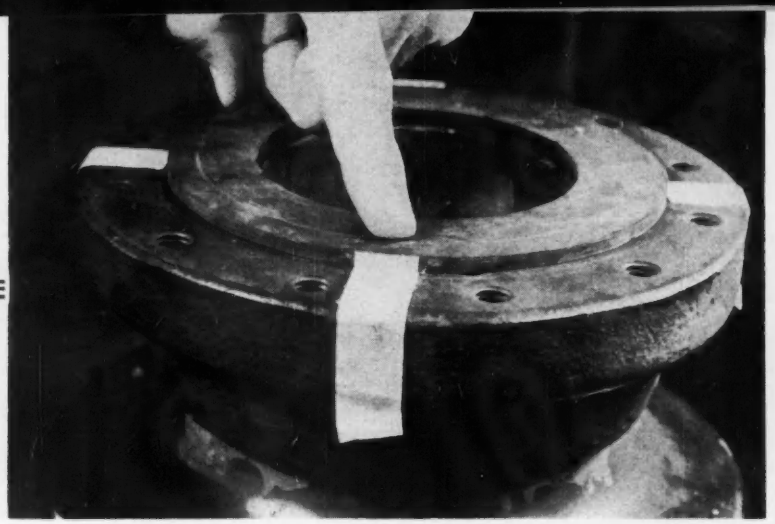

Tape Holds Gasket for Bushing Assembly

C. M. CRAWFORD, Maintenance Man, Ohio Power Co, Zanesville, Ohio —AEP System

When reassembling oil-filled bushings at Ohio Power Co, strips of masking tape are applied to the outer edge of the bushing gaskets—this simple means of retaining the gaskets cuts bushing reassembly time in half, while minimizing the possibility of gasket damage, poor seals, associated bushing leaks.

The components of most high-voltage, oil-filled bushings are joined by means of gasketed, bolted joints. Nitrile rubber gaskets are used in these joints to secure a good gasket of long life; this gasket joint must be almost perfect to insure that oil does not leak out and to prevent moisture entrance.

Previously, the operation of positioning the gasket and retaining it in place during bushing assembly was somewhat tricky. When the bushing sections were brought together, it was necessary to keep the gasket centered by probing between the two sections to keep the gasket on its intended bearing surface, the bushing porcelain. Nitrile rubber requires a very smooth, clean bearing surface and this prevents the use of a sticker compound to hold the gasket in position.

To solve this problem, four or five strips of masking tape are spaced evenly around the clamping ring to position the gasket. The tape must not be applied to the bearing face of the gasket, because it must be removed later. Applied to the outer edge of the gasket, the tape has sufficient holding power to retain the gasket in place, when the section is inverted for assembly. When the two sections are bolted together, gasket compression prevents its displacement, and the tape can be removed before the bolts are finally drawn down.

Simple technique saves about two to four man-hours per bushing. Number of bushings rebuilt annually varies considerably; an average of 24 bushings per year were rebuilt during the last three years in Zanesville District.

Starling Stampeders Face Language Barrier

A starling "startler," an amplified tape recording of a starling's distress cry, is stampeding these aerial pests to good effect at Tennessee Valley Authority's switchyards. However, to adopt this method to solve starling problem in a particular geographical area, tape recordings of *local* starlings must be used.

To get ours, says Jim Barnwell of TVA's electrical test laboratory, "we caught a local starling and recorded its distress cry. It's used at night when the birds come into roost—they're particularly troublesome in switchyards in the wintertime because of the heat which these yards put out."

The startler was developed by a research group at Pennsylvania State University and another group in France.

But, says Barnwell, the tapes made in France "don't work very well in Pennsylvania and those made in Pennsylvania don't work well in France, or Chattanooga, Tenn.—perhaps there's a language barrier."

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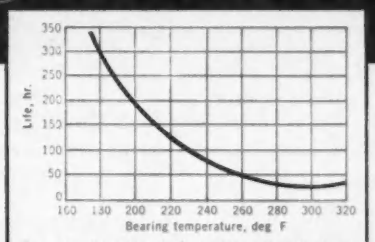
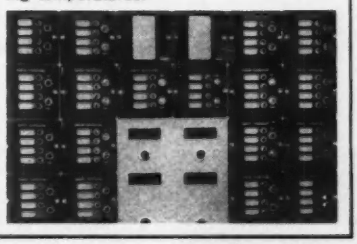


Temperature vs. fatigue life of a tin-base babbitt bearing at a unit load of 2000 psi.

Dozens of machines at as many different locations can be watched from a single panel for signs of excessive bearing operating temperatures.



There are three basic ways to combat the steadily rising cost of plant operation. Two of them are hard ways: buying higher capacity initial equipment, or, trying to find more efficient equipment. So many advances have already been made in these directions that any overall economy you may gain in the future promises to be small.

But the third way to save—and this is the easy one—is to increase the *reliability* of your equipment, thereby lowering your maintenance expenses and perhaps even reducing the amount of standby equipment needed. *Omniguard* is a proven *supervisory system* that enables you to do just this. It continuously supervises bearing temperatures in your heavy rotating equipment, preventing bearing failures and *extending* bearing life, sometimes by years. Omniguard also monitors lube oil pressures, pump suction and discharge pressures, and other variables of a critical nature. Monitors and indicators installed at any convenient location away from the equipment, display the readings and provide warning signals and automatic shut-down of equipment if desired.

Omniguard keeps constant watch on the important temperatures and pressures in your plant—makes it easy for you to avoid the expensive repair jobs and down time that would otherwise be part of your operating expense.

For complete information on the Edison Omniguard System, and the variations available for different kinds of machinery, write for Catalog 3036D.

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INSTRUMENT DIVISION
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Static Switching Regulates Voltage Fast

JAMES S. MALSBARY, Supervisor-Special Product Development, Wagner Electric Corp, St. Louis, Mo.

Static switching of the regulating winding of a power transformer gives almost instantaneous regulation of output voltage for distribution service or for an industrial plant. Saturable reactors, controlled by magnetic amplifiers responsive to output voltage, initiate voltage correction instantly and restore voltage to within 1% of the desired output level in one or two seconds.

In other applications, the new system can hold load at a constant current level, regulate load division between paralleled transformers, or regulate the temperature of electric heating.

A usual installation of this new concept has a three-winding transformer. Two are conventional high and low-voltage windings, as in a power transformer. The core carries a third, or regulating, winding with sufficient turns to give the maximum rated voltage correction. This regulating winding is connected to opposite vertices of a four-reactor bridge whose remaining vertices are connected through a fifth reactor in series with the load and the conventional low-voltage winding. Each reactor has a separate dc winding on its core which can be excited to any degree of magnetic saturation.

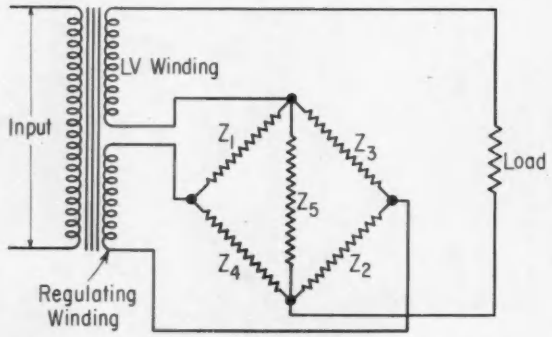
Error sensing and control equipment for the five saturable reactors is entirely static and consists of self-saturating magnetic amplifiers and associated components. A static detector actuated by an error signal, originates an appropriate signal that is amplified and applied to two magnetic power amplifiers connected in opposition. One controls the dc in saturable reactors Z_1 and Z_2; the other, in reactors Z_3 and Z_4. A third magnetic power amplifier, controlled by the first two, supplies dc to by-pass reactor Z_5.

When the transformer's low-voltage winding voltage is at the required level, the static control reduces dc to a minimum in reactors Z_1, Z_2, Z_3 and Z_4, so they present high impedance to current from the regulating winding. It also saturates Z_5 with heavy dc to pass load current freely. Thus the regulating winding is effectively cut off and the load current shunted around it.

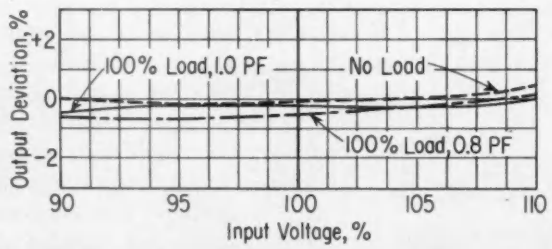
If required voltage calls for boosting the low-voltage winding's voltage, reactors Z_1 and Z_2 are given enough dc to reduce their impedances while dc is reduced to boost the impedances of Z_3, Z_4 and Z_5. This puts the regulating winding in series with the low-voltage winding to boost its voltage, the amount of boost being determined by the amount of dc in the reactors.

If, on the other hand, the low-voltage winding's voltage must be lowered, reactors Z_3 and Z_4 are saturated with dc while Z_1, Z_2 and Z_5 are allowed to desaturate. This connects the regulating winding in series to buck the voltage of the low-voltage coil.

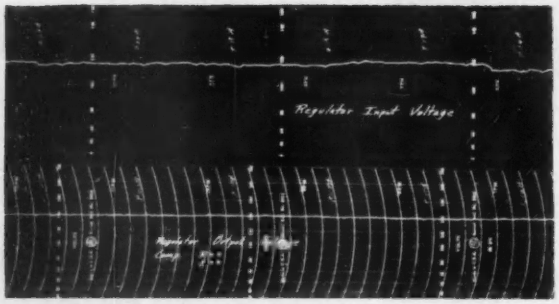
The scheme is equally applicable, with the high-voltage winding omitted, to a voltage regulator. A 3-phase, 150-amp, 12-kv industrial installation has demonstrated ability to hold rated output voltage within ±1% for any input from 90 to 110%. It does this for any load from zero to 100% and from 0.80 lagging to any leading power factor. This installation completes its corrections in 50 cycles, smoothing a varied input voltage to a nearly flat 120 v. Although the saturating reactors might be expected to introduce harmonic distortion, oscillograms show little evidence of it.



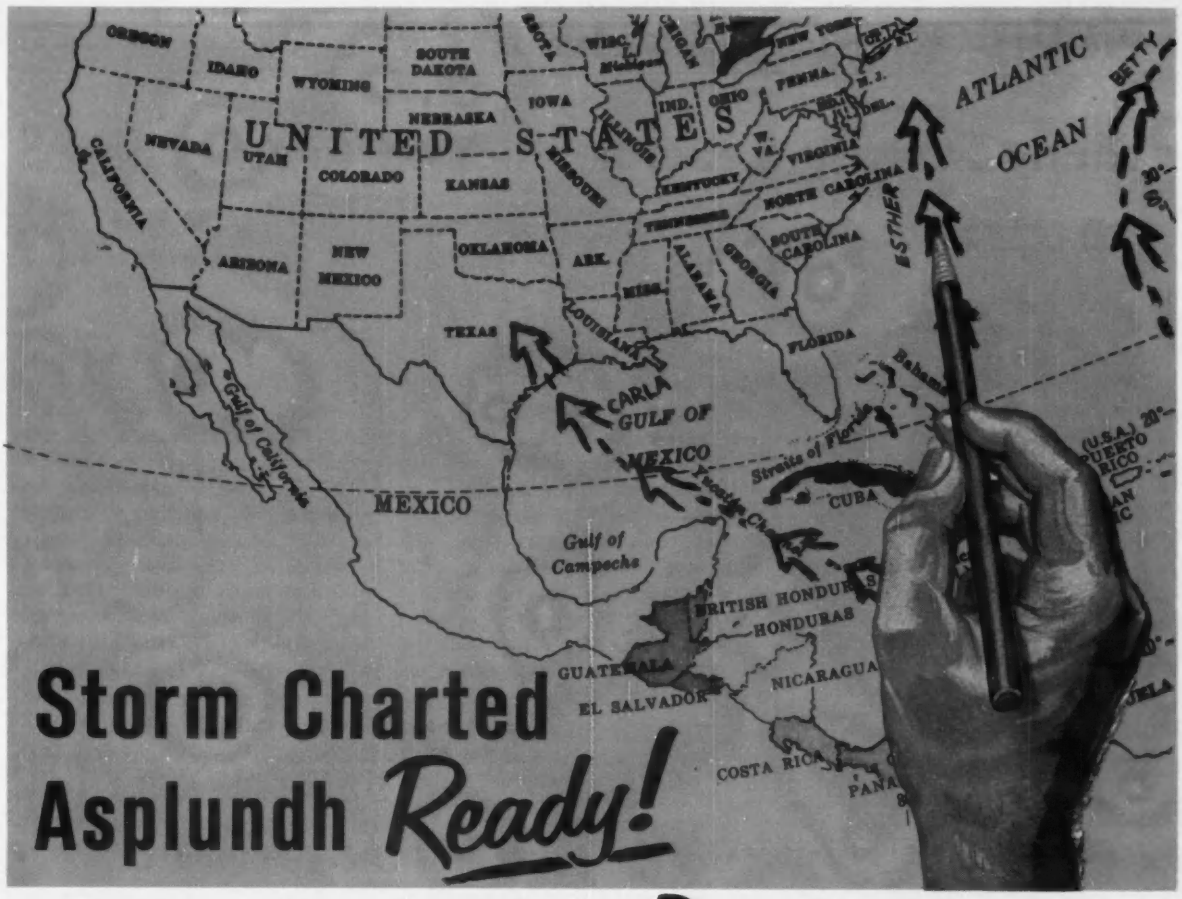
SATURABLE-REACTOR BRIDGE controlled by static devices switches and reverses series winding to regulate voltage



VOLTAGE DEVIATES LESS THAN 1% through range of loads and power factors for input voltage from 90 to 110%



OUTPUT VOLTAGE CHART (lower) shows regulator's correction of 12-kv input variations (upper) at industrial plant



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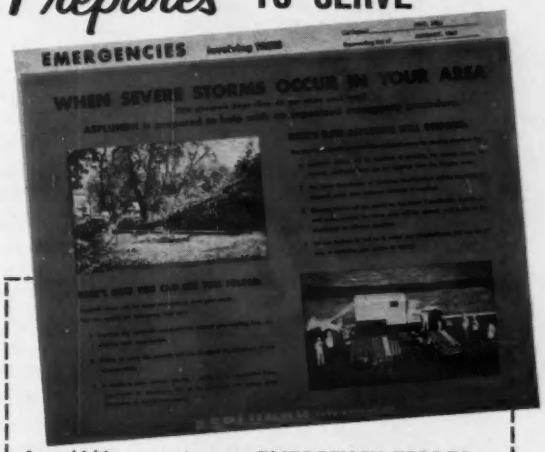

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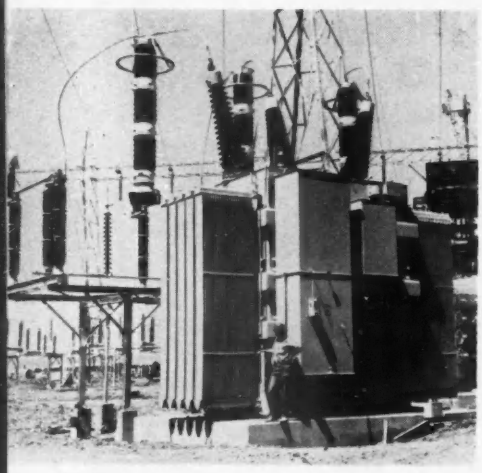


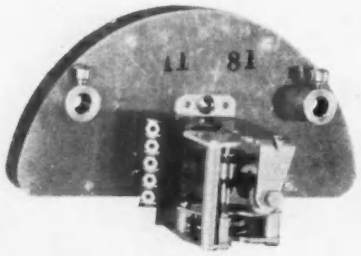
A 25,000-kva, 230-kv shunt reactor, said to be the largest and highest voltage such reactor built in the US, was recently shipped by Westinghouse Electric Corp to the Arizona Public Service Co. It is being used at the Cholla steam-electric plant near Holbrook, Ariz.

The reactor has been connected near the mid-point of the new 300-mile, 345-kv transmission line through a 345/220-kv autotransformer to compensate for the capacitive charging reactance of the high-voltage lines. This transmission line, longest 345-kv line yet constructed in the US, will deliver the 800-Mw capacity of the Four Corners plant in northwestern New Mexico to the load centers in southern Arizona.

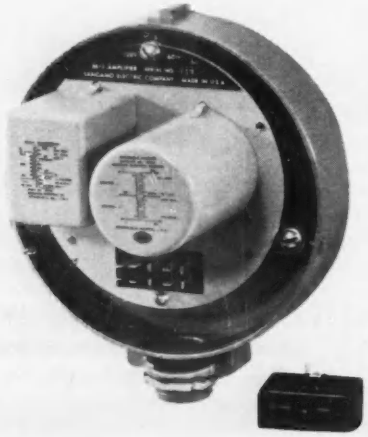
The air-core winding of the reactor is completely shielded magnetically phase-to-phase and phase-to-tank. The winding uses the shell form coil and patented Insuldur insulation. Core and coil assembly is enclosed in a Form Fit tank.

In the past, reactive kva was provided by low-voltage reactors generally placed across the tertiary windings of transformers connected to transmission systems. However, this 230-kv shunt reactor permits application of the reactance where it is required.

Mfrs Reveal Meter Developments



GENERATOR, (above) photo-conductive cell pulse-type, is mounted on a watthour meter register. Amplifier is below, with connector plug removed



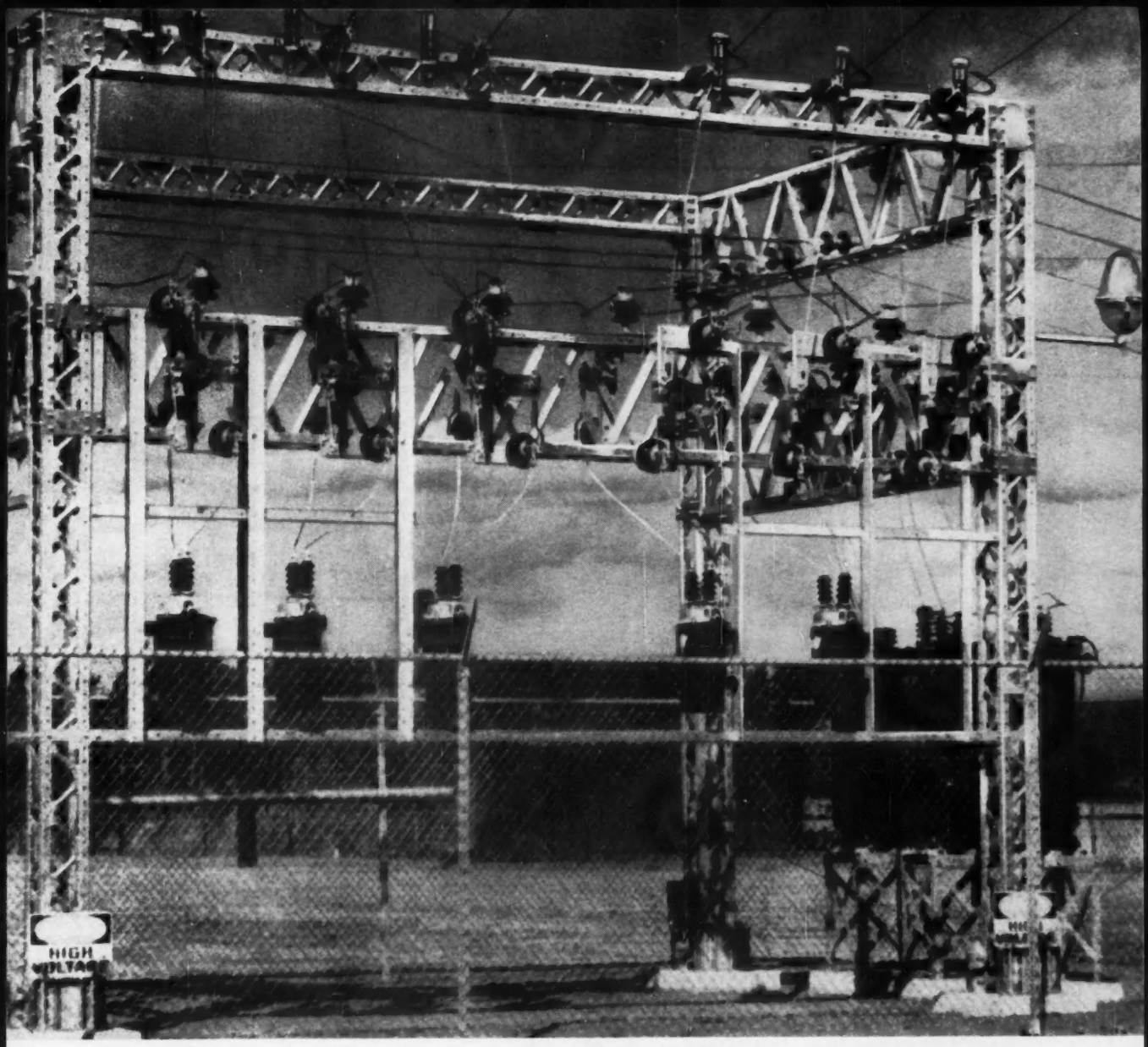
Sangamo Electric Co of Springfield, Ohio, and Landis & Gyr, Inc, of New York City, introduced pertinent, significant new products to the EEI/AEIC Meter and Service Committee Meeting held last week in Springfield, Ohio. Sangamo representatives described in detail their new solid-state pulse generator and amplifier now in production. Landis & Gyr engineers covered their "demand billing and load survey" automatic data-processing and telemetering equipment.

Sangamo's new solid-state pulse generator and amplifier, the M-1, can be used with their two and three-stator meters and their digital demand recorder. The M-1, without contacts or relays, provides more pulses per revolution of the meter disk, while minimizing friction imposed on the moving system. Two cadmium sulfide photo-conductive cells are employed in the generator to initiate pulses. Transistors and a saturable reactor in the solid-state amplifier detect and amplify pulses to the operating level of the digital demand recorder. The demand recorder counts the pulses and provides maximum average demand data on punched-paper tape. Generator and amplifier units are available which will deliver up to 100 pulses per min.

Landis & Gyr's high-speed processing system for demand billing and load survey printing, automatic chart scanning and punching on cards of average demand readings consists of a code printer, timing clock, handprinter, optical scanner and punched cards.

The codeprinter is an impulse-operated recorder which digests up to 4,800 contacts per hr and prints the demand on a strip chart in clear 4-digit numerals, reportedly insuring a resolution of better than 1/1,000 even for intervals as short as 15 min. Impulses received during the printing operation of the codeprinter, called the Maxiprinter, are accumulated in a storage device. The pulsing system is 2-wire which requires clean contacts. Where 3-wire contact devices are used, a simple separate pulse converter is available.

(*Continued on page* 50)



Aluminum Substation.

Substation construction has become a stand-out showplace for Olin Aluminum. Under the most difficult climatic and construction circumstances, special aluminum alloys engineered by Olin for designs by McGraw-Edison, have proved themselves in customer savings. First, aluminum substations are 50 to 65 per cent lighter than steel—with the same load carrying capacity. Field construction time can be as little as one-fourth that of identical steel structures. Second, aluminum requires no painting. Third, power interruptions, usually required for maintenance, are eliminated. Fourth, aluminum simplifies grounding—saving both materials and labor, and adding a safety factor over steel. This great versatility of aluminum in substation operations is largely to the credit of Olin Aluminum's technical research and development staff. Their genius is creative use of alloys and design to make one dollar do the work of several—through the right use of the right aluminum. This staff is at the call of your company—through your area Olin Aluminum Sales Office or the nearby Distributor.

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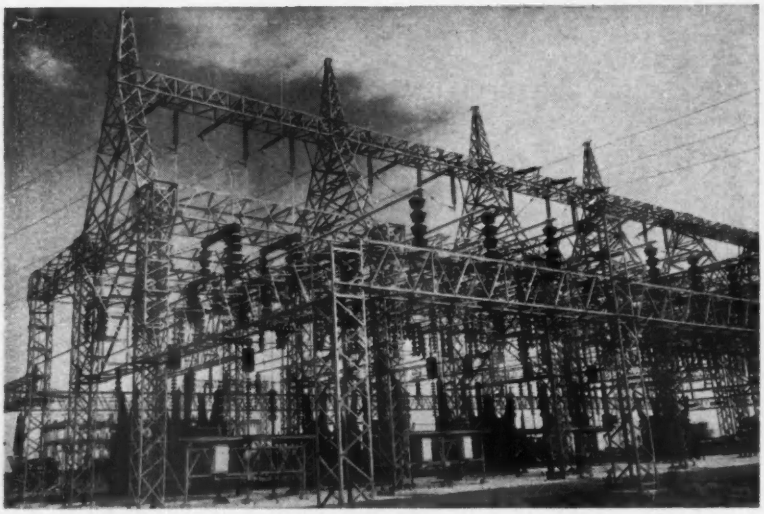

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Reveal Meter Developments

(*Continued from page* 48)

CODEPRINTER CHART contains recorded values in numerical and coded form for direct reading and local billing if required and for automatic processing of demand billing, load survey

The optical scanner reads the coded metered values printed on the right-hand side of coded chart and controls the card punch. It was stated that the scanner processes a punched card, comprising 12 chart lines plus a 5-digit consecutive card number in about 4 sec. A monthly chart roll with a 30-min. integrating period can thus be processed in about 8 to 9 min.

In their presentation to the Meter and Service Committee, Landis & Gyr engineers divided and described their telemetering equipment in three categories: torque-balance telemeter; pulse-frequency system and telemeter; and audio-frequency telecommunication system.

Arizona PS Awards 345-Kv Breaker Contract

General Electric Co has received a $1-million order for 20 air-blast power circuit breakers for Arizona Public Service Co's Four Corners project—a 310-mile, 345-kv transmission system which will connect northwestern New Mexico to Phoenix, Ariz. (EW, May 29, p 74).

Destined for the first 345-kv system in this part of the country, it is said to be one of the industry's

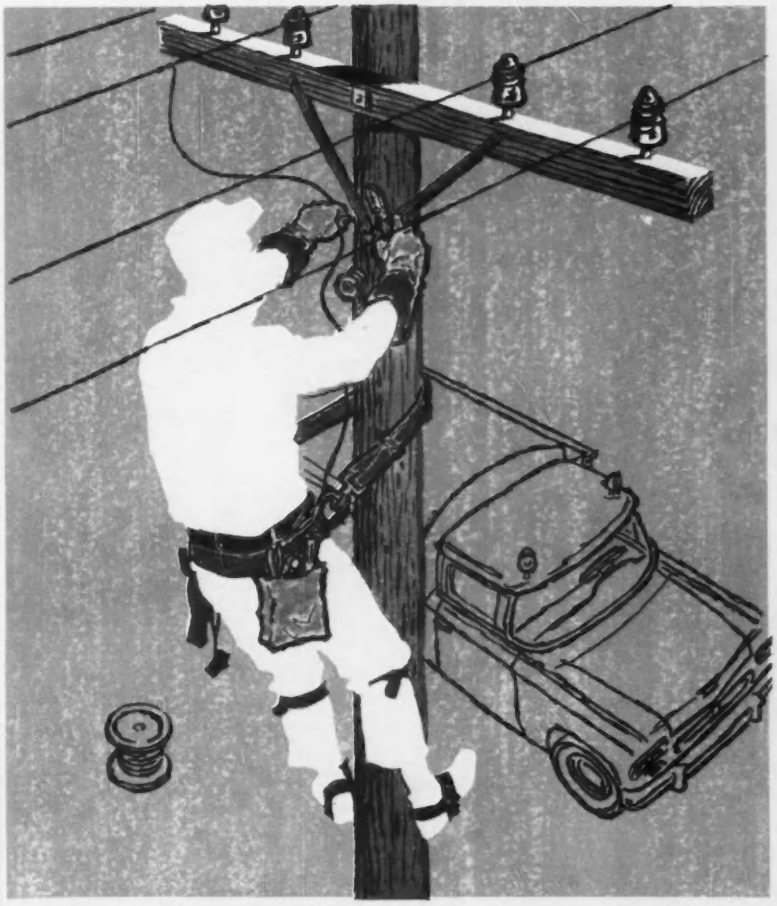
largest orders for such protective equipment. Four of the breakers are 345-kv, two-cycle, 15,000-Mva units and four are 230-kv, 15,000-Mva—two of which will be two cycle, the other two, three cycle—for the Cholla steam electric station. Five 230-kv, three-cycle, 15,000-Mva breakers are for the Four Corners station. The balance of the order, seven 230-kv, 15,000-Mva units, will go to Pinnacle Peak substation, near Phoenix.

MANUFACTURERS BRIEFS

• **Burndy Corp,** Norwalk, Conn., has set up a subsidiary in Turin, Italy, called **Burndy Electra of Turin.** Initially, it is capitalized at $16,000—eventually to be raised to $160,000, and it will produce electric and electronic equipment and appliances. The Connecticut manufacturer has also opened a new, 25,000-sq-ft plant in Malines, Belgium, for its wholly-owned Belgium subsidiary, **Burndy Electra SA.** The modern, one-story structure houses administrative, technical services, production and warehousing facilities for Burndy's European operations.

• **Kennecott Copper Corp** has purchased a site in the Lexington Park section of Lexington, Mass., for its new basic research laboratory. The program will be directed toward obtaining fundamental knowledge and discovery of new scientific facts pertaining to the metals industry, emphasizing solid-state physics of metals. Research projects to improve the recovery of copper and other metals from ores, improve the quality of fabricated products and develop new ones already are underway at Kennecott's research center at Salt Lake City, Utah and at its fabricating subsidiaries: **Chase Brass & Copper Co** and **Okonite Co.** The location of the laboratory was chosen because of its proximity to Harvard and MIT Universities and to Boston, which is considered a prime research center. Recruiting and organization of the program will occupy the nucleus of the ultimate staff, which will be housed in temporary quarters at Lexington for the construction period of about a year.

personnel? --or personnel problems?



Next time you need line crews, consider the advantages of using a qualified contractor's facilities. You'll spare yourself the usual headaches of hiring and laying off, employee processing and training, absenteeism, etc. For special projects—or on a long range basis—the qualified contractor offers:

- the skills and equipment you need *when and where* you need them
- precise cost accounting
- reduced equipment overhead
- firm job completion dates and written performance guarantees

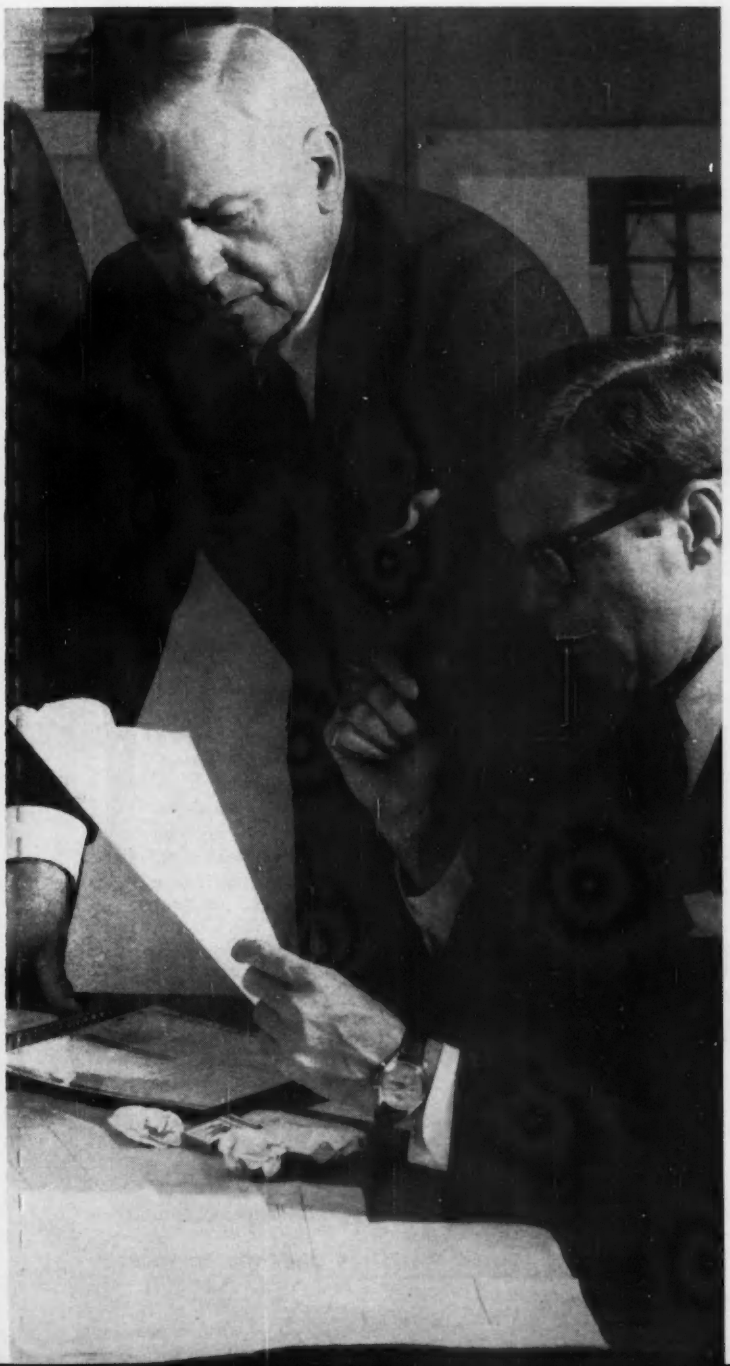
In addition, he can probably do the job at less cost to you. For names of NECA contractors, write

NECA

National Electrical Contractors Association, 610 Ring Building, Washington 6, D. C.

If it's your responsibility . . .

to purchase distribution transformers, then it's important you consider Moloney!



Why Moloney?

Because Moloney's philosophy of "Total Design" results in lower cost of use.

You know how *cost of use* can make the difference between transformers. Moloney puts great emphasis on the lowest possible transformer *cost of use*. To accomplish this, no one design feature is stressed at the expense of another. Instead, Moloney uses a "Total Design" philosophy which is important to you because it provides balanced design. This means fewer outages and efficient transformer operation, resulting in lower *cost of use*. Moloney's patented testing system assures the user that Moloney Transformers have successfully passed all tests and are electronically approved for service. Over the years this design philosophy will mean savings of many dollars per transformer.

When you purchase distribution transformers, be sure you consider the "Total Design" Moloney Transformer.

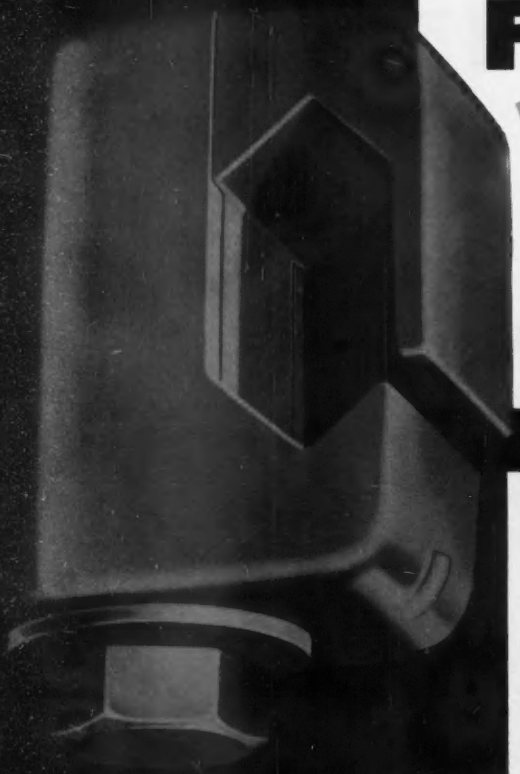
ME 61-32

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers and Switchgear for Utilities, Industry, and Electronic Applications

Unsurpassed for

High Conductivity
Ease of Installation
Safety
Over-all Economy



FARGO "5000" *Series* CONNECTORS

THE ORIGINAL VISE-TYPE CONNECTOR

Grips like a vise . . . because it is built like a vise.

Fargo's "5000 Series" Connectors feature the "one piece" . . . vise type design that tightens smoothly and stays tight.

. . . the "5000 Series" offers the longest contact in the field for a long lasting low resistance connection.

. . . the "5000 Series" is carefully engineered to put more material in the areas of maximum stress to assure maximum trouble free performance and reusability.

. . . the "5000 Series" is designed to provide the most clamping force on the conductors at the lowest torque for a permanent, vibration proof connection.

This original vise-type connector is the basis of the complete line of Fargo Connectors for copper or aluminum. They are fast, easy to apply and all "Series" can be installed with "hot" tools.

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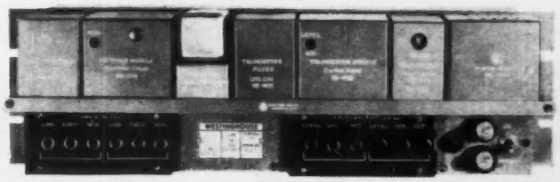
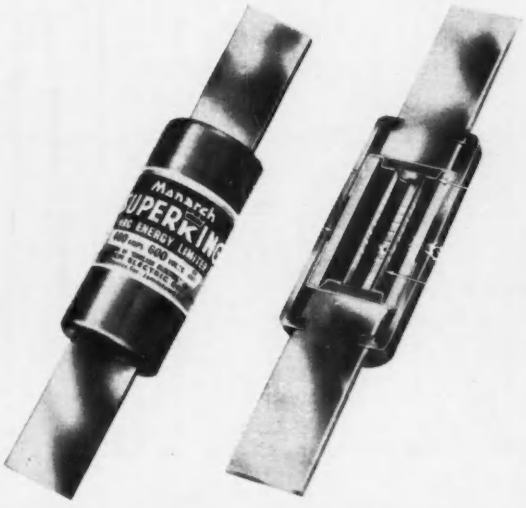
3-In.-Bolt Circle Insulators . . .

. . . cap-and-pin type, for switch and bus stacking, serve applications from 115 through 161 kv at 450 through 750-kv BIL, with but two sizes required for this range. The insulators' high-strength alumina porcelain is said to provide a greatly improved safety factor and about double the strength of standard electrical porcelain; repeated cantilever tests in the laboratory have failed to fracture them. Their mechanical strength is about the same as that of NEMA standard 5-in.-bolt circle units of comparable ratings. Reportedly they provide more leakage distance from live parts to ground than NEMA standard stacks of the same rating and, because the units weigh up to 30% less, a saving in cost of 30 to 35% is said to be achieved by utilizing lighter, less costly structure members, bus support hardware. Electrical ratings are those of I-T-E's TR-140 5-in.-bolt circle units.
I-T-E Circuit Breaker Co, Victor, N. Y.

Audio-Tone Equipment . . .

. . . is designed to use two tone frequencies from 595 to 2,975 cps, 340-cycle spacing, with trip contacts in series. Operating time is about 1 cycle (60-cycle basis) pickup and dropout. Type TA, completely transistorized and of modular construction, employes plug-in units for various combinations to meet requirements of each specific application. Frequency-shift audio tones of the units are suitable for operation of pilot-wire or microwave channels; are equally adaptable to direct underreaching, permissive underreaching, or permissive overreaching transfer-trip relaying. Temperature range is from −10 to +50C. Power supply is capable of operating from 48, 125 or 250-v dc.
Westinghouse Electric Corp, Pittsburgh 30, Pa.



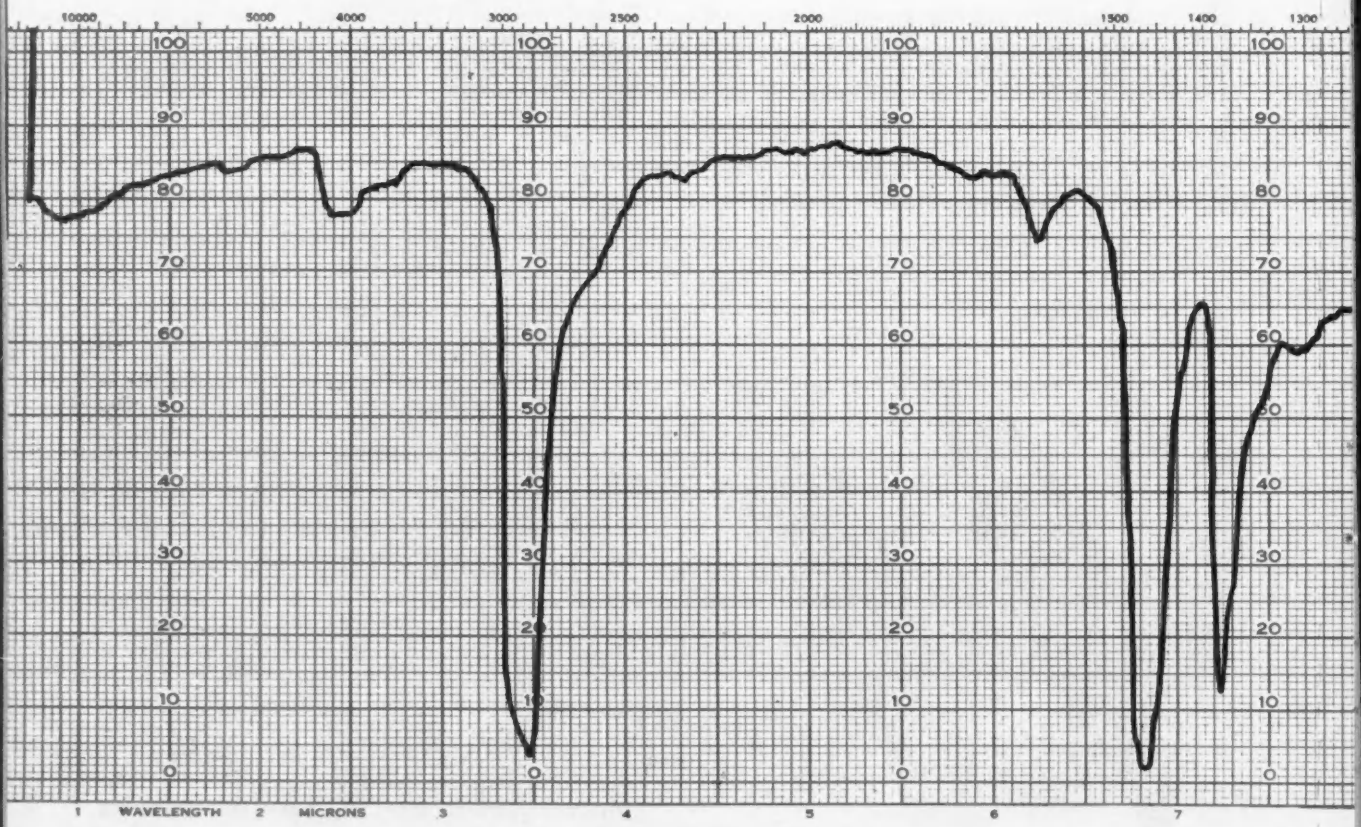


Current-Limiting Fuse . . .

. . . has interrupting capacity of 200,000 rms symmetrical amp, and reportedly operates silently without flame, smoke, or explosion. The SuperKing HRC fault-energy limiter is available as a NEMA Class H limiter, suitable for standard NEC fuse clips with voltage ratings of 600 and 250 v and current ratings of 1 through 600 amp. It is also available as a NEMA Class J limiter, suitable for rejection-type fuse clips, with voltage rating of 600 v and current ratings 1 through 600 amp. Construction includes silver elements hermetically sealed inside a ceramic cartridge—to give SuperKing its non-deterioration feature. Blades and ferrules are silver-plated to prevent deterioration of contact surfaces.
Monarch Electric Division, El-Tronics, Inc, Jamestown, N. Y.

If it's electrical cable, pure as the driven snow isn't pure enough. Take the oil saturant for paper cable, for example. Even tiny impurities, one part in 10,000, will affect the performance of the cable. Our Research and Development Department uses an infrared spectrophotometer to establish standards for each type of saturating oil. These standards, using both qualitative and quantitative spectroanalysis, are so high that they are beyond the limits of normal organic analysis. Using spectroanalysis graphs, like the one below, our research department can determine the composition and the molecular structure of organic materials in their original state. Changes in the structure and composition after actual or accelerated service tests can also be detected. Only the oil saturants

This is what purity looks like



that can pass these tests are pure enough to be used in USS Tiger Brand paper cable.

This is just one of the many ways our Research and Development Department makes sure the quality of USS Tiger Brand Wire and Cable is the best that money can buy. Our research laboratory studies and evaluates all the materials used in Tiger Brand products. We are always experimenting with new materials and methods to make a better cable for you. We have the facilities, right in our laboratory, to make all kinds of experimental cables—from control cables up to high voltage cables.

That's why, whatever the job, it pays to specify USS Tiger Brand Electrical Wire and Cable. American Steel and Wire, Dept. 1432, Rockefeller Building, Cleveland 13, Ohio.

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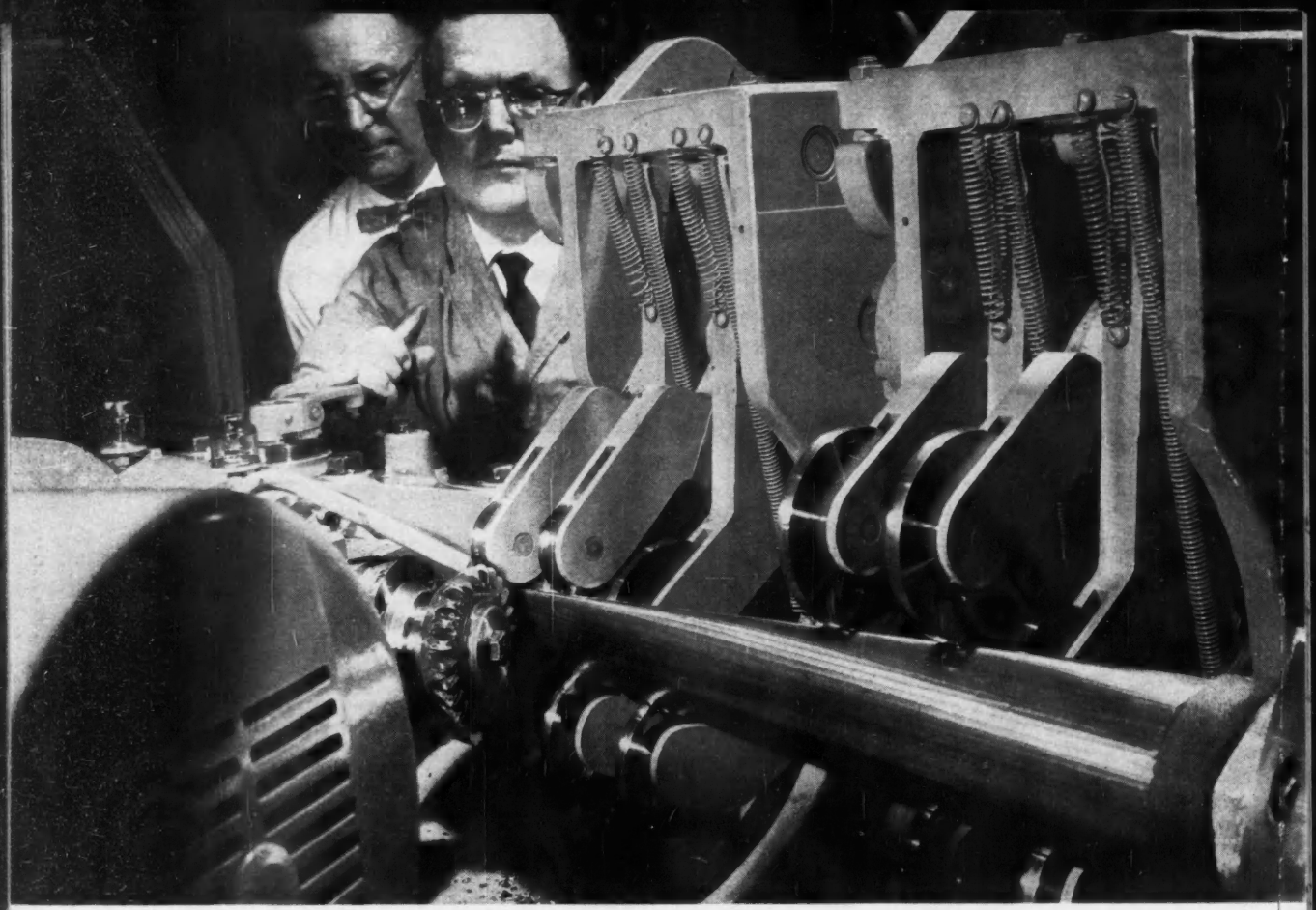


Steam turbine buckets of maximum efficiency are made on this tape-controlled profile miller.

Large steam turbine triple play... from drawing to tape to bucket

At General Electric, turbine buckets with airfoil contours of maximum efficiency are automatically milled to exact tolerances. One result: Increased efficiency with more power from more compact steam turbines.

This high-speed precision production is accomplished with a tape-controlled profile miller. A drawing is translated onto magnetic tape and the tape fed into the milling machine's tape reader. The machine, fully automatic, mills each bucket to identical tolerances.

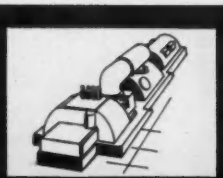
The numerically controlled profile miller is just one of the many precision machine tools used by General Electric to produce the best turbine-generators possible. Other automatic equipment is used for drilling, boring, welding, reaming, tapping, and assembly.

All of these many operations characteristic of modern manufacturing contribute to the quality and performance of each General Electric steam turbine-generator long before it is placed in service. And this quality and performance remain for the many years of each unit's life. 244-10

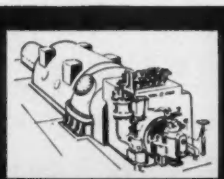
Progress Is Our Most Important Product

GENERAL ELECTRIC

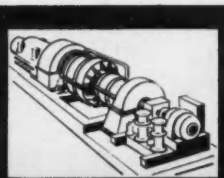
General Electric Turbine-Generators Help Keep Power Costs Low



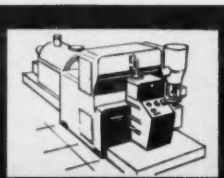
Steam turbine-generators for large blocks of power



Steam turbine-generators 100,000 kw and lower



Gas turbines for peaking, base load, combined cycles

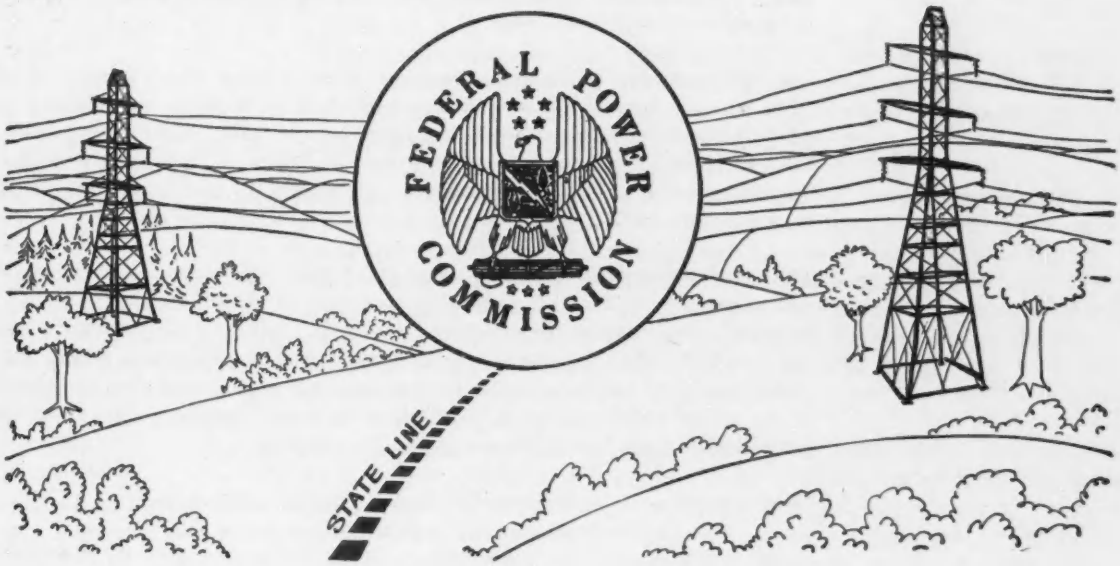


Mechanical drive steam turbines for auxiliaries

Electrical World

OCTOBER 9, 1961

Management Newsletter



FPC Jurisdiction—What Does It Mean?

PART 1 OF A TWO-PART SERIES

The Federal Power Commission found itself in an unaccustomed and unwelcome position in the public eye early this year when the controversial Landis Report characterized the Commission as the "worst example" in the federal government of "a breakdown in the administrative process." In the intervening months President Kennedy has had a singular opportunity to alter FPC operations.

Like falling leaves, four of the five Commissioners holding office on Kennedy's inaugural have departed, replaced by new nominees. Only former chairman Jerome Kuykendall remains, and persistent rumors hold that Kuykendall will resign before expiration of his term next June. His resignation would leave a board of five Kennedy men at a time when, potentially, the Commission could assume a far stronger role in the electrical industry than for some time in the past.

Interconnections, grids, bulk transmission, kilowatts by wire—who builds what, when and how—are occupying a greater slice of news space than most people can remember them doing in the past. And this is a prime area of FPC authority. What has Commission jurisdiction over interstate power transfer meant in the past? And what is it likely to mean in the future?

The Landis attack focused primarily on the FPC's role as a regulator of the gas industry—a role which usurps by far the greater portion of Commission time. Commissioners have been heard to mutter wryly about the "endless parade" of gas company executives passing through their offices. Suggestions have been made to split the Commission in two facilities handling each industry's problems. This proposed dichotomy has met with little enthusiasm on the part of Commission

personnel, but they realize that coping with a tidal wave of gas cases badly handicaps electric operations. And relations with the electric industry have been reasonably smooth anyway.

It wasn't always thus. Men still on the Commission staff can remember being jailed by local authorities in the embattled first few years after passage of the Federal Power Act of 1935.[3] Many utility men regarded the FPC with feelings similar to those accorded revenue agents by moonshiners. But the FPC policeman and the utility citizen have learned to live with each other under more amiable terms. There are still areas of considerable dispute, but the deep antagonisms of the past have largely faded away.

The FPC came into being under provisions of the Federal Water Power Act of 1920[4] and was, until 1935, concerned primarily with hydroelectric development of navigable waterways. It still has this function. In 1935, culminating a bitter series of investigations and accusations concerning utility and regulatory practices, amendments to the 1920 act were passed[5] which gave the federal government, in the guise of the FPC, a strong voice and real control of interstate power.

The extent of that power took shape over a skeleton provided by a series of important court tests of Commission strength, nearly all of which upheld FPC contentions and strengthened its grip on interstate power. Part II of the 1935 act[6] holds that jurisdiction shall apply to a "public utility," which is defined as a person who owns or operates facilities for the transmission of energy in interstate commerce or the sale of electric energy at wholesale in interstate commerce. Facilities for generation or local distribution are specifically excluded.

There are still some facets of the jurisdiction question undetermined, but the basic ground rules can be drawn up. If you have transmission lines crossing a state boundary and power flows across them, you are a "public utility" by definition. If you have transmission substation facilities tapping an interstate line, there may still be a question. In *Connecticut Light & Power Co v. FPC*[7] substation facilities were thus held to be local distribution facilities, but the change in Supreme Court personnel since that time and their decisions in other cases[8] indicate that that case may no longer hold. And an earlier Circuit Court case, which the Supreme Court declined to review, went so far as to hold that even if the utility in question had no physical facilities for interstate transmission, its books, records, memoranda, accounts and other such assets constitute such facilities insofar as they are used in connection with interstate sales.[9]

There is obviously plenty of room left for controversy. But from the case of *Jersey Central Power & Light Co v. FPC*[10], which established the Commission's first foothold in regulation of utilities whose physical property did not cross state lines, to the high-water marks cited above, jurisdiction issues have been more clearly delineated.

There are a limited number of utilities to which this poses a problem, as the largest segment of the industry has conceded the fact of FPC jurisdiction. There are, today, 180 major utilities "classified" as interstate systems. Another 130 are classified intrastate, and 34 have been placed in an "unclear" category. And there are about 500 minor systems that the FPC has never bothered to look at—either they are clearly too small or non-jurisdictional.

The Commission has merely labeled the systems in this manner for administrative purposes. They can officially become interstate only by issuance of an FPC order after a determination to that effect. This occurs only when the matter, for some reason, comes before the entire Commission. But none of the 180 has objected to the classification.

The "unclear systems" are classed as intrastate until their status is settled. This

means that although the systems are intrastate now, the Commission watches them. Any move indicating a change in status will bring the regulators on the double.

The weight of the FPC hand on the corporate shoulder may well depend on the accounting stresses developed in changing to the Commission's Uniform System of Accounts. As the FPC and the National Assn of Railroad and Utility Commissioners are now in general harmony on a standard accounting system, few states require a procedure much different from the Commission's. For those that have a different system, estimates of the costs of conversion and going to a dual set of books have run as high as $1 million.

When a company first comes under FPC jurisdiction, it must file a one-shot "reclassification and original cost" report. It may be more than an inch thick. This is expensive, and it's generally related to accounting procedures. If the FPC procedures have been previously adopted, compilation of the report is naturally simpler.

Interstate systems are held responsible for a number of periodic reports which all systems must file. The reports are used only for statistical purposes in the case of intrastate systems, but those of interstate systems are subject to checks. All systems file annual reports, but only those of interstate systems must follow FPC accounting provisions. The question of whether the Commission can compel use of FPC accounts in the annual report sent to stockholders is presently before a Commission examiner with evidence that an appellate decision will be sought by whichever side the examiner rules against.

Interstate systems must also file other plans with the Commission: These include (1) issuance of securities—provided the system is owned and operated in a state where state jurisdiction over such issues isn't exercised; (2) requests to merge—provided the company is not subject to the Holding Company Act of 1935[9] and therefore required to file merger plans with the Securities and Exchange Commission; (3) filing of wholesale rate schedules for resale of interstate power.

The reports required by the FPC of all systems can be broken into about three categories: (1) the big annual report of financial and operating data; (2) the series of monthly reports on energy consumed, peaking loads, capacity and power exchanges; (3) other reports—annual reports on "typical electric bills," transmission changes and additions above 22 kv, rates, systems where two or more utilities are operating in a single city, additions or changes in licensed power projects, and monthly reports on generating plants, operating statements, and monthly electric bills in 52 cities for the Labor Department's Bureau of Labor Statistics (used to determine the cost-of-living index).

The Commission checks its reports and applications from interstate systems carefully. Spot audits are made on annual reports. They are reviewed mathematically and to see that FPC procedures are followed. Regional offices also review the "monthly power statements" for accuracy. But legal recourse for the Commission against intrastate utilities which report inaccurately is limited.

Treatment of the capital account—especially depreciation and acquisition adjustments—has always caused the most fist-shaking and breast-beating in utility-FPC encounters. Original cost accounting has always been, and probably always will be, a cornerstone in the FPC system of accounting. Federal courts developed a fair-return-on-fair-value theory some time ago.[10] Then they almost, but not quite, changed it to a fair-return-on-estimated-cost-of-reproduction formula[11], and finally changed it to a return-sufficient-to-meet-the-needs-of-the-particular-company formula in the case of *Hope Natural Gas Co v. FPC.*[12] But again the change in personnel of the US Supreme Court raises the question of whether the *Hope* case is worth much as a rate basing precedent. But original cost remains firm.

The actual effect of these Commission rate rulings is, for the most part, minor.

For most utilities, the percent of their revenues obtained under FPC-regulated rates is far smaller than that coming under state jurisdiction. But for others the interstate slice of the pie is much more significant.

In the important matter of normalization v. flowthrough for rate treatment of liberalized depreciation or accelerated amortization, the FPC has come down on the side of utilities in favoring normalization. In a hearing concerning Amere Gas Utilities Co, the FPC said, "The argument that the sums in the reserve account will rightfully belong to the ratepayers, or that the ratepayers will bear any burden that they do not now bear by reason of the creation of the reserve is wholly erroneous." In Northern Natural Gas Co hearings, the Commission provided for a 1.5% return on deferred income tax accruals, dividing the benefits of liberalized depreciation between the company and the ratepayers.

Again, this applies only to interstate power. And keeping multiple sets of books—especially where state and federal systems are widely divergent—is both expensive and confusing. And the administrative delay introduced by another regulator is admittedly a drain on funds. Basically, though, the argument reduced to its simplest form is that no one wants any more regulation than necessary. It's a reasonable one, and one that the FPC generally is willing to accept.

What do utilities get for this added regulatory burden? According to the Commission, there are some fairly substantial benefits. First, coming under the Uniform System of Accounts—gestation pain aside—provides a sound, nationally uniform method of keeping utility books. Systems can be compared by stockholders and security analysts. And the danger of writeups of property and other excesses laid at the door of utilities thirty years ago can never be repeated. Now utilities have, in effect, a stamp of federal approval.

Securities only get a going-over if there is no state authority doing a similar job and no SEC jurisdiction. Only nine states do not regulate utility securities. However, this free financial advice is seldom welcome to utility vice presidents, and, in practice, it would take some pretty questionable financing to get an FPC blackball. The Commission is not out to exercise management authority.

And from the mass of information fed into the FPC by utilities comes a wealth of statistical data. Most of it would be available through other sources only after painstaking assembling and evaluating. Though much of it is overwhelming in its detail, it is undeniably helpful to utility planners.

Interconnection studies are also made by the Commission. A small staff and limited funds keeps these studies on a small scale, but many of the interconnections advocated by the Commission have come to pass. The primary task of the Commission in the field of interconnections is to cajole, not browbeat. There is an emergency provision under which FPC can force interconnections, but the utilities connected are then exempt from the accounting and reporting provisions.

Though nobody loves a cop—at least one whose primary concern is parking violations—the FPC has, by and large, a reasonable, arm's-length approach to the electric industry. It has been respected by the utility industry it polices. Compared to relations between other federal agencies and the industries they regulate—the Federal Aviation Agency and Federal Communications Commission are good examples—the FPC and electric utilities have gotten along very well. We shall examine the possibilities and probabilities of FPC's future next week.

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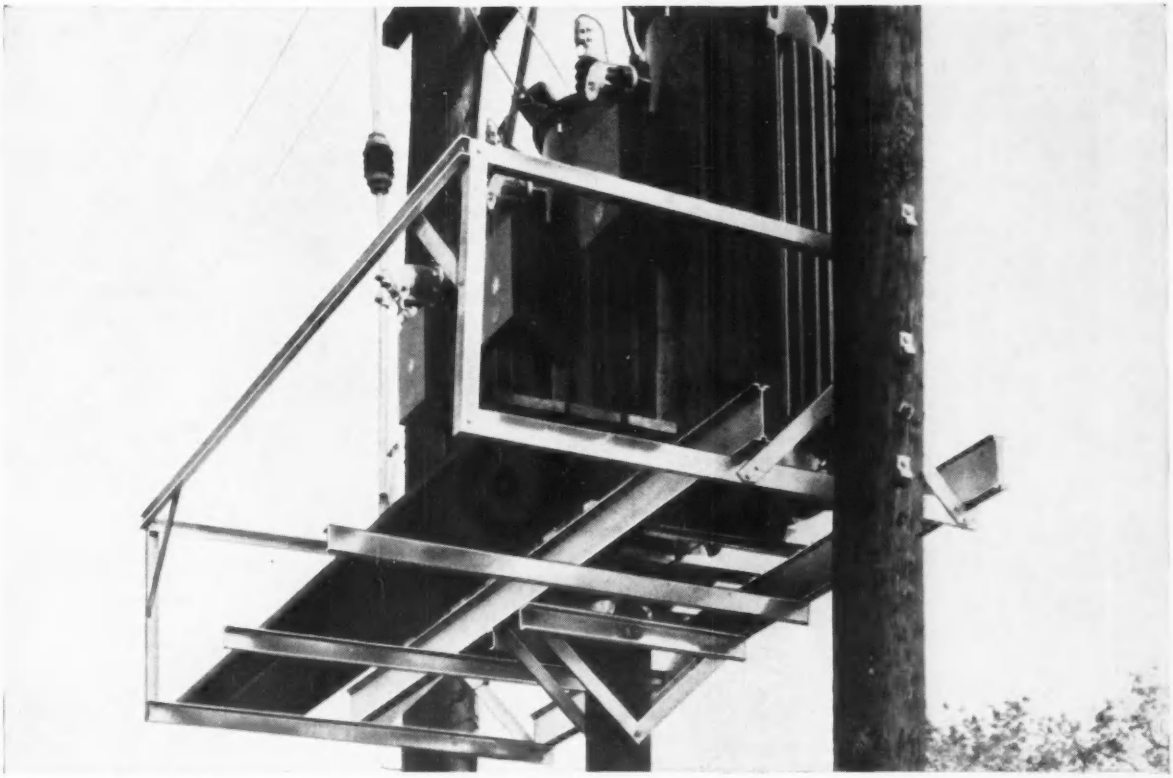
[1] 49 Stat. 863, 16 U.S.C. § 825 (1958).
[2] 41 Stat. 1063 (1920).
[3] 49 Stat. 863, 16 U.S.C. § 825, supra note 1.
[4] 49 Stat. 863, 16 U.S.C. § 825-6, supra notes 1 and 3.
[5] 324 U.S. 515 (1945).
[6] Continental Oil Co. v. Federal Power Commission, 266 F. 2d 208 (1959).
[7] Hartford Electric Light Co v. FPC, 131 F. 2d 953 (1942), cert. denied, 319 U.S. 61 (1943).
[8] 129 F. 2d 183, 319 U.S. (1941).
[9] 49 Stat. 803, 15 U.S.C. § 79 (1958).
[10] Smyth v. Ames, 169 U.S. 466 (1898).
[11] McCardle v. Indianapolis Water Co, 272 U.S. 400 (1926).
[12] Hope Natural Gas Co v. FPC, 320 U.S. 591 (1944).

NEW ALUMINUM PLATFORM
for Transformers and Regulators



Light Weight – High Strength – Low Cost

This newly designed platform of Reynolds Aluminum weighs 210 pounds. Two men can have it in place, ready for business, in just 30 minutes. Compare this with a steel platform, same size, that weighs 700 pounds and takes 2½ hours to install. Even though it is produced of high strength aluminum alloy and weighs only one-third that of steel, the platform costs no more. The catwalk pictured on the above platform is optional, and is available for both a 2-pole and 3-pole installation.

Further savings in time and cost resulted from the unique design of the extruded aluminum members. An unlimited number of adjustments can be made in the field to accommodate different size transformers and regulators and no additional holes need be drilled. Only two sizes of fastening bolts are needed, where four were formerly required. In addition, there are the added advantages of minimum maintenance and high resistance to corrosion.

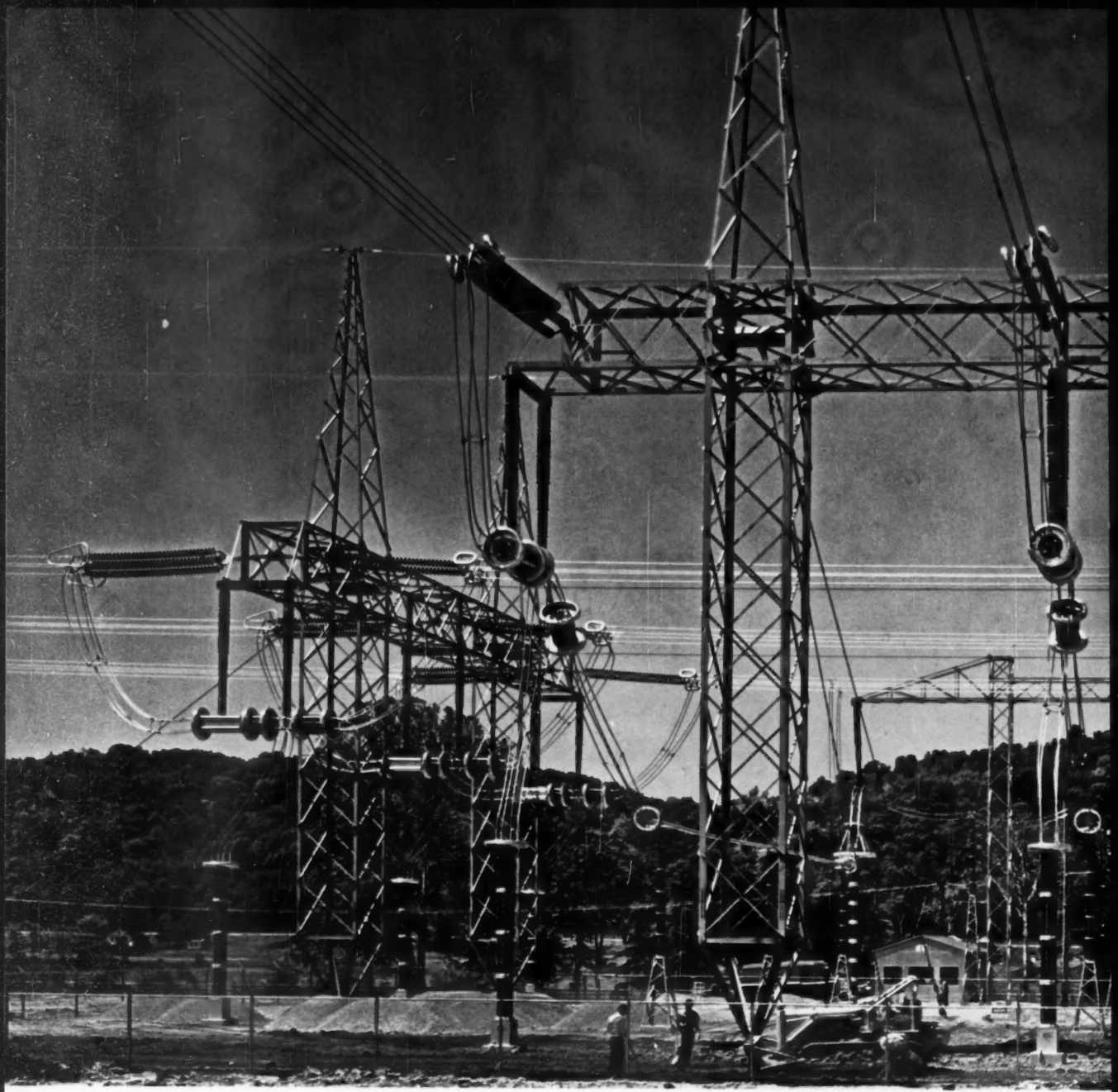
Reynolds Engineers worked very closely with the manufacturer, Utility Products Mfg. Co., P. O. Box 1431, Memphis, Tennessee in designing this platform.

Regardless of whether you purchase or manufacture electrical equipment, aluminum's unique combination of advantages can be of value to you.

Reynolds engineers are available to help translate these advantages into better products for the electrical industry. Contact your nearest Reynolds office or write to *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Va.*

REYNOLDS ALUMINUM

Watch Reynolds exciting TV programs on NBC: the Dick Powell **Reynolds Aluminum Show** every other Tuesday; **Say When** weekdays; and **All Star Golf**—in living color—every Saturday.



Apple Grove, W.Va.
June 22, 1961—
Westinghouse
and American Electric
Power threw the switch on
a prototype 750kv line

APPLE GROVE advances the art of Extra High Voltage transmission.

The 750-kv transmission test project at Apple Grove will save electric utilities millions of dollars in the future. Research conducted here will evaluate new techniques and equipment developed by Westinghouse for EHV transmission of huge blocks of power.

Research objectives are:

SIMULTANEOUS comparison of radio influence and corona loss performance of 2 conductor diameters in 3 different configurations under identical atmospheric conditions.

EVALUATION of mechanical features of sub-station, towers, conductors and hardware.

EVALUATION of electrical features of transformer, arresters, coupling capacitors and conductors.

EHV lowers the cost of transmitting bulk power:

REDUCES power line losses.

REDUCES capital cost of transmission facilities.

REDUCES need for new rights of way.

EHV interconnections permit more efficient power pooling:

REDUCES amount of generating capacity now tied up as reserve for peak loads and reliable service.

REDUCES capital cost of new generating capacity through the application of larger units.

REDUCES generating cost through improved efficiency of larger units.

REDUCES generating cost by locating plants close to lower cost fuel.

IMPROVES economic tie-line dispatch.

Apple Grove, W.Va.
Westinghouse transformers are ready now to power tomorrow's EHV lines

Westinghouse has pioneered the technical developments which have lead to the high voltage transmission systems of today. In particular, EHV transmission of the future presents no problems for Westinghouse transformers. The exclusive "Form-Fit"® corona-free design with forced oil cooling, close-fitting tank and vertical coil construction result in EHV transformers that are both smaller and lighter per kva making possible the manufacture of capacities necessary for the ever larger stations of tomorrow. Westinghouse transformers are ready now to serve any foreseeable voltage level—meeting the challenge of the super-voltage future.

125,000 kva, 3-phase, auto-transformer steps up 138 kv-supply voltage to 750,000 volts at the joint Westinghouse-American Electric Power test facility at Apple Grove, W. Va. During initial test, lines were energized at 775,000 volts, establishing an EHV record.

Since 1886—Westinghouse "Contributions" help electric utilities keep pace with America's growing power needs.

1886 George Westinghouse introduced first A.C. transformer into the United States.

1890 first 3000 volt A.C. system installed at Portland, Oregon.

1897 first 40,000 volt transformer.

1907 first condenser bushing — an Industry standard today.

1921 first 220,000 volt transformer.

1932 introduced vacuum filling and corona-free design. Pioneered impulse testing—confirmed high voltage designs. Introduced Hipersil, grain oriented core materials. Introduced forced-oil cooling to increase transformer loading 66⅔%.

1935 built the 287,000 volt Hoover Dam transformers—highest transmission voltage at that time. Reduced dielectric test level.

1943 introduced "Form-Fit"®, shell form tank, reducing transformer weight and size.

1946 first 500,000 volt experimental transformers used at Tidd EHV Project.

1952 first 345,000 volt commercial installation of power transformers.

1956 built world's largest sound test room.

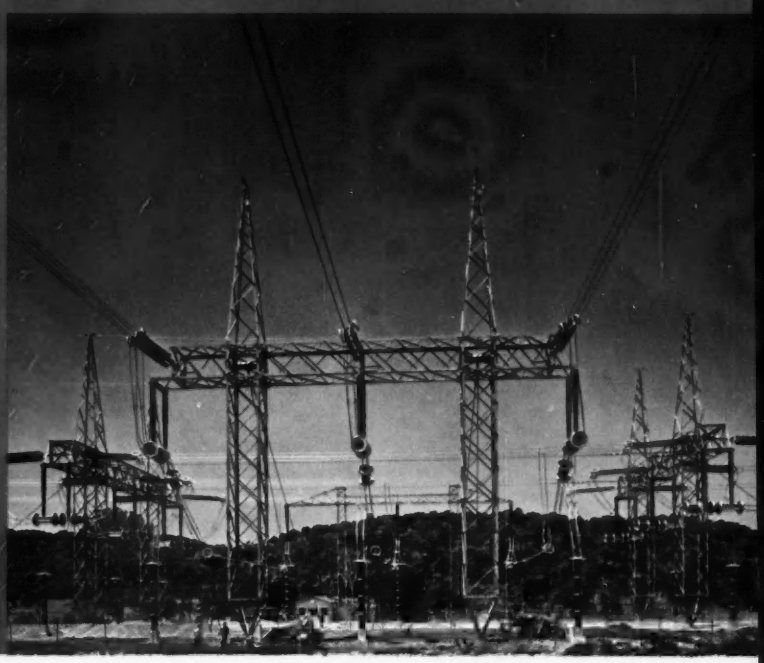
1957 designed and built the first Schnabel railroad car to facilitate transformer shipment. First high altitude EHV tests at Leadville, Colorado.

1958 introduced inner-cooled construction to reduce transformer weight and size up to 25%. Introduced INSULDUR® insulation to permit 10% greater thermal overload capability.

1960 introduced an improved INSULDUR® insulation to permit 12% greater continuous thermal capability at 65°C.

1961 completed design and began construction of 600 MVA transformer—world's largest. Westinghouse and American Electric Power conducted first EHV tests at Apple Grove at a 775,000 volt level.

B



C

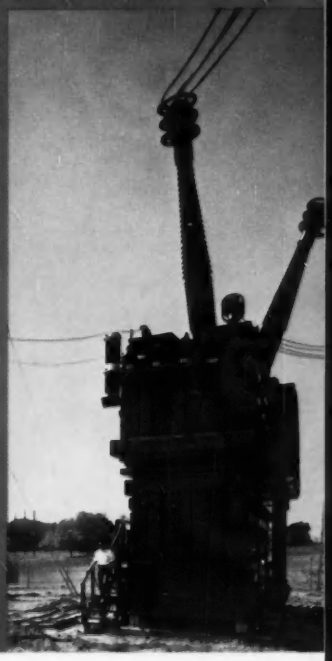
Apple Grove

project is a typical example of
Westinghouse research and development
in meeting America's future power needs.
Such major programs stem
from the support of electric utilities through
their purchase of Westinghouse equipment.
As a result, when you purchase
Westinghouse products you also are helping
provide the knowledge and experience
necessary to build power systems
scaled to the need of the future.
You can be sure . . . if it's Westinghouse.

A

D

E



F

A. Greenhouses contain meters to check radio influence on each line at distances of 100 to 200 feet from center phase. Three meters in each group are all of different design and based on three different theories of radio influence generation.

B. De-couplers block radio-influence (RI) on any one line from interacting with that produced on other two lines, allowing simultaneous independent readings.

C. From central substation, three 2400-foot, 3-phase test lines extend to form a "T". Each line uses different sized, bundled conductors on 18-inch centers. A heating current is carried in each conductor to prevent condensation and simulate actual operation.

D. Three 528-kv station-type lightning arresters protect the 750-kv windings of the auto-transformer from line surges and lightning strokes.

E. Control panel and electronic recorder that logs data from 60 test points at 20-minute intervals. Abnormal readings will automatically reduce interval to every 2 minutes.

F. 125,000 kva, 3-phase auto-transformer steps 138,000-volt supply to 750,000-volt test voltage. Condenser bushings, 24′ in overall height, are rated at 1800-kv BIL.

CP-1065

Westinghouse

NEW economy | NEW safety | NEW efficiency

ON ROUTE DELIVERIES ALL-NEW 'Jeep' FLEETVAN

Payload	1,000 pounds
Engine	Hurricane, 4 Cyl. F-Head, 72 hp.
Wheelbase	81 inches
Overall Length	154 inches
Load Space Volume	170 Cu. Ft.
Interior Height Rear Load Area	62½ inches
Length of Load Area	87½ inches
Interior Width Load Area	57 inches

Here's the newest, most economical walk-in delivery van you can buy—the sensational new 'Jeep' Fleetvan. Ideal for multi-stop delivery use! The Fleetvan parks easy. Maneuvers easy. New safety-designed front lets the driver see the road just a short way in front of the bumper. And the Fleetvan gives top gas economy too. These are just a few of the reasons the U. S. Post Office purchased over 6,000 'Jeep' Fleetvans. For full information on the 'Jeep' Fleetvan write to Mr. R. J. Kreusser, Fleet Sales Manager, Willys Motors, Inc., Toledo 1, Ohio.

'Jeep' FLEETVAN ®

WILLYS MOTORS, INC., TOLEDO, OHIO. ONE OF THE GROWING KAISER INDUSTRIES

more run for your money!

WARN® HUBS
on your
4-WHEEL DRIVE!

That goes double—more run for your money from your vehicle as well as the hubs. Your 4-wheel drive lives longer, handles easier, costs less to own, is more versatile with Warn Hubs, because they "cut out" the front drive in 2-wheel drive — stop drag, save gears, tires, gas. And Warn Hubs give you the utmost in "selective drive" convenience, dependability and satisfaction too, because they are *made* that way. Choose Warn Lock-O-Matics for automatic selective drive, or Warn Locking Hubs for the most dependable manual control hubs. You get more for your money either way.

Models for all makes 4-wheel drives. Ask your dealer for Warn Hubs next time you see him.

WARN MFG. CO.
Riverton Box 6064-EW
Seattle 88, Wash.

News Scope

STUDY—Two International Atomic Energy Agency specialists conferred with United States officials in Washington last month about operation of four nuclear facilities which the US has offered to place under the IAEA safeguards system. Dr Dragoslav Popovic, IAEA safeguards division director, and Paul Szasz, member of the agency's legal division, then toured the sites of the four reactors—Piqua organic cooled and moderated reactor, experimental boiling water reactor at Argonne (Ill.) National Laboratory, and the graphite and medical research reactors at Brookhaven National Laboratory.

CAPACITY BOOSTER—A 66-Mw North Dakota lignite coal-fired steam generator will be added to Otter Tail Power Co's Hoot Lake Station at Fergus Falls, Minn., in mid-1964, more than doubling the station's capacity.

REHEARING SOUGHT—Niagara Mohawk Power Corp is seeking a rehearing of a New York Public Service Commission order that would cut a proposed $11-million rate increase to less than $4 million. "This is the first instance in over a decade where the commission has held that a utility in the Niagara Mohawk class was not entitled to earn a return of at least 6%," a Niagara Mohawk Power spokesman declared.

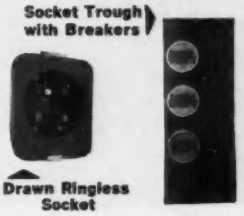
Protector Fuses

(*Continued from page* 39)

use on some 480-v networks because their arc products are completely confined within their tubes, eliminating flash and spatter. They provide time-current characteristics somewhat similar to those of enclosed copper fuses, but are not physically interchangeable with enclosed or other types. They are also sensitive to temperature, therefore cannot be mounted inside network protector enclosures. For proper operation, vault ambient must not exceed 32 C and additional rise in the fuse enclosure must not exceed 15 C.

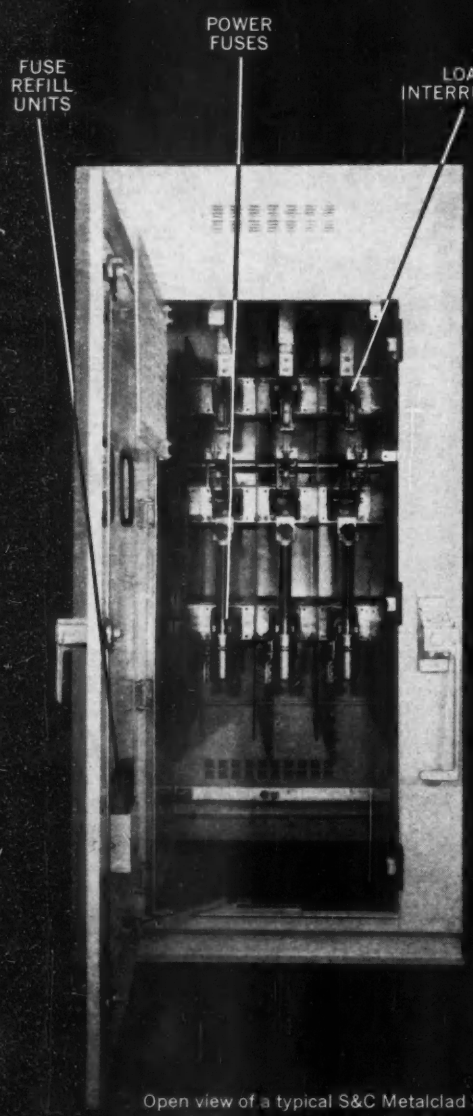
Searching for Meter Sockets?

TOOK TO...
SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON 1, OHIO
A Subsidiary of
The Union Metal Manufacturing Co.



Write for a free Catalog outlining types and sizes of meter socket equipment, test switches, test blocks, reactiformers and enclosures.

Reclosing is for the birds



Open view of a typical S&C Metalclad Switchgear bay. Note power fuses, load interrupters. Fuse refill units are conveniently stored in the door.

So why buy this feature in your 2.4 thru 14.4-kv switchgear?

Reclosing is for the birds, squirrels, tree limbs, lightning, icing, windstorms, and kite strings that frequently cause non-persistent faults on open distribution lines of utility systems. Reclosing re-energizes the lines to restore service in a fraction of a minute.

But when faults occur on the enclosed power supply circuits of industrial plants, commercial and institutional buildings, you don't want to reclose on them. These faults —while extremely rare—are permanent. Someone has to locate the trouble and repair the equipment or cable—or at least isolate it—before the system can be re-energized. So why buy expensive circuit breaker type switchgear with its automatic reclosing feature?

S&C Metalclad Switchgear—employing fused load interrupters—gives the ideal protection for enclosed power supply circuits. Power fuses furnish the fault protection (load interrupters switch the load). After a fault occurs, you simply replace the inexpensive fuse refill unit (typically costing $13.50) while the fault is being located and corrected.

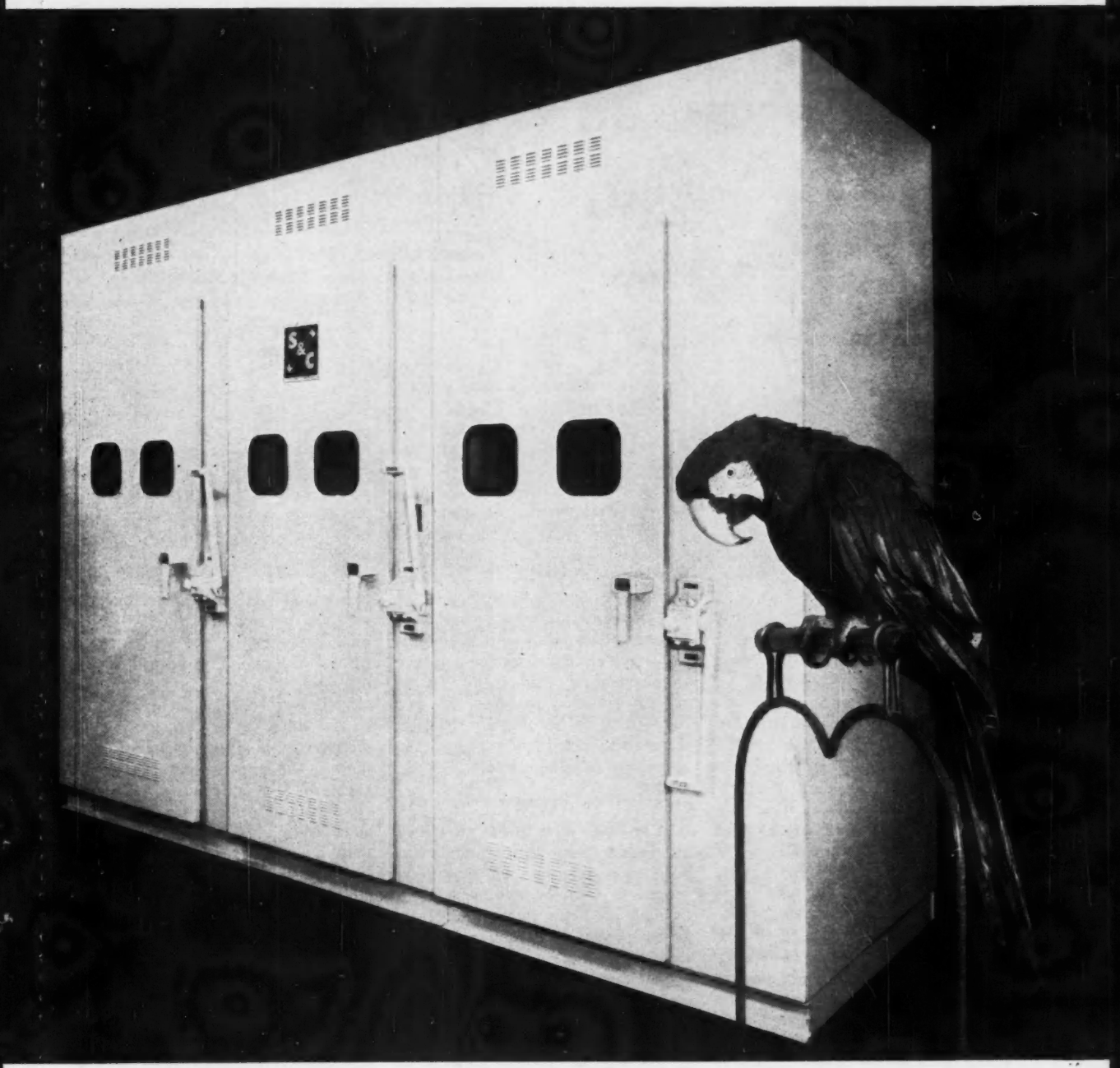
The economics all say, "Reclosing is for the birds." Why pay for a function you can't use?

Cut your high-voltage switchgear costs in half by specifying S&C Metalclad Switchgear for your 2.4 thru 14.4-kv switching centers, service entrances, substation primaries and secondaries. Get full-load switching to 1200 amperes and fault interrupting to 500,000 kva.

See the Yellow Pages (Electrical Equipment) for your nearest S&C sales engineer. Or write to:

S&C Metalclad Switchgear meets all NEC requirements for fault-closing, short-circuit interruption. Performance proved by high-power testing at KEMA laboratories.

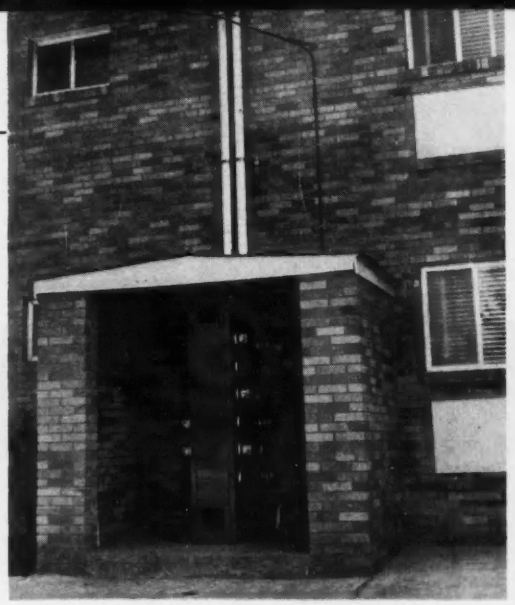
S&C ELECTRIC COMPANY
4421 Ravenswood Avenue • Chicago 40, Illinois
Specialists in High Voltage Circuit Interruption since 1911



The equipment is an S&C Metalclad Switchgear Assembly rated 13.8 kv, for a switching center.
The bird, a green-winged macaw, is an optional extra, obtainable at your local petshop.

Sharp Increase in All-Electric Apartments Seen In Georgia

Resistance-heated apartments showed 300% increase in last 16 months



FREE-STANDING 600-amp service entrance was designed for a group of all-electric apartments

J. **WYMAN LAMB**, Commercial Sales Engineer, Georgia Power Company, Atlanta, Georgia

Several factors have keyed a sharp increase in all-electric, including electrically heated, apartments in the Georgia Power Co service area since Jan. 1, 1960. These factors include:

1. Georgia Power's residential wiring program, which also covers apartment dwellings.

2. Aggressive sales activity in which residential and commercial sales engineers have played an important part.

3. Growing acceptance of the all-electric concept on the part of apartment builders and dwellers.

On Jan. 1, 1960, Georgia Power was serving 136 all-electric apartment units. Of these, 112 were heat pump installations and only 24 were electric comfort heating, using some form of electric resistance heaters. In just 16 months, 96 all-electric apartment units were added, an increase of 70.6% in the all-electric apartment units served. Of the 96 new installations, 72 were of electric resistance heating, increasing the number of apartments heated with resistance units by 300%. Heat pump installations showed a 21.4% increase.

The first step, and real key, to the sharp upswing in electric heating is Georgia Power's residential wiring program which went into effect on January 1, 1960. This program gave the sales force a new tool and made the picture more attractive to apartment builders.

When an apartment builder installs adequate wiring and electrical appliances for cooking, water heating and electric heating, Georgia Power pays $200 per apartment unit toward the cost of service entrance facilities for the building. A particularly attractive feature from the apartment owner's viewpoint is the fact that Georgia Power purchases, assumes ownership and maintains the heavy electrical service entrance to the building. This means that the service entrance facilities will not be allowed to become obsolete, an important consideration to the apartment building owner.

Aggressive Promotion Program

A second factor in the growth of all-electric living in apartments has been an aggressive sales promotion program. Owners and apartment dwellers are being shown that:

1. By proper construction and insulation of buildings and through proper installation and operation of equipment the many advantages of all-electric living can be well within the budget of the average family.

2. Electricity is the only utility service that is cheaper now than it was 10 years ago.

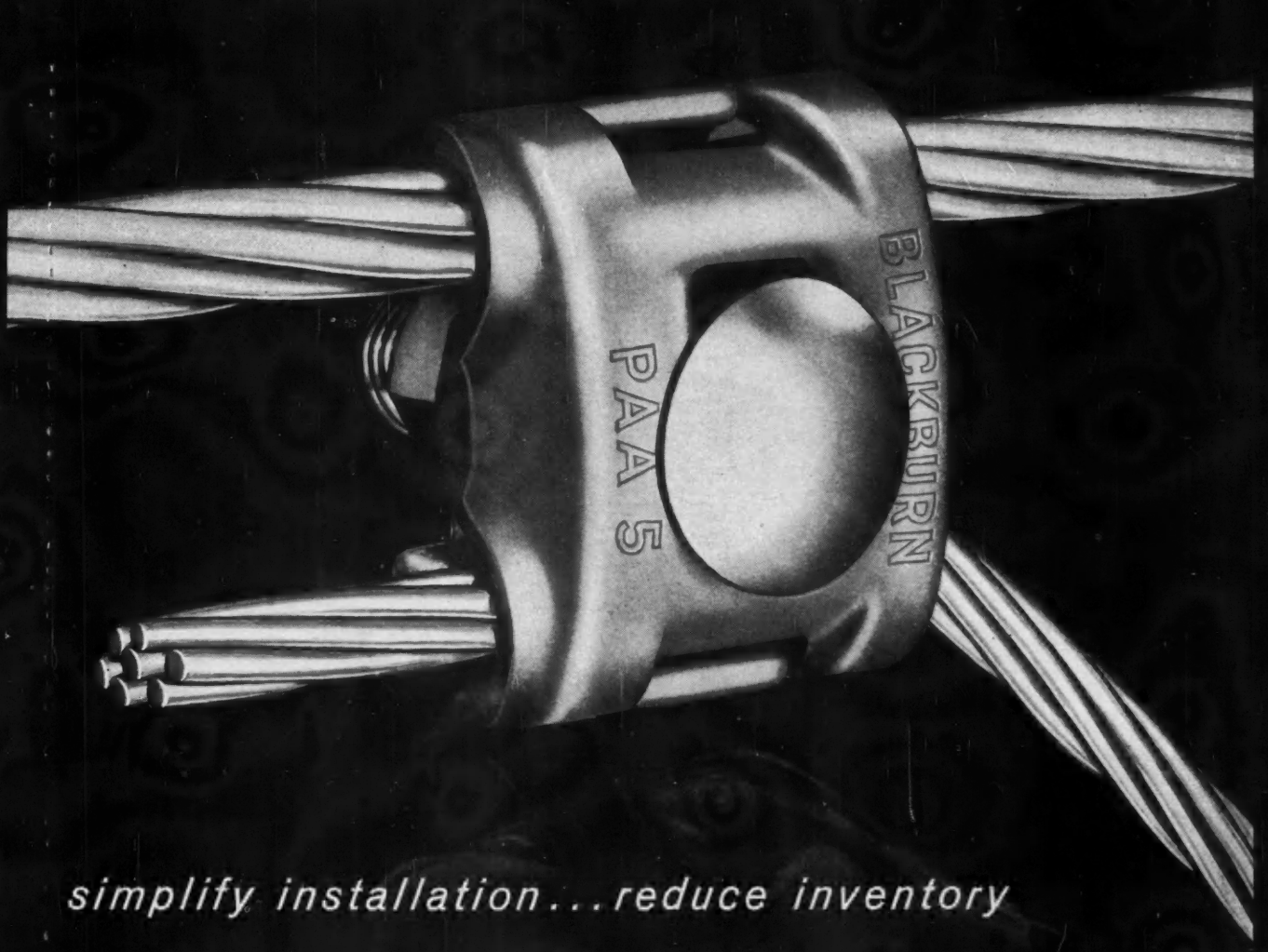
Apartment owners are then asked to keep in mind the constantly increasing cost of fossil fuels and the steadily rising operating costs for conventionally heated apartments. They are asked to contrast this with the downward trend in the cost of electrical energy. By comparative operating cost analyses, they are shown that the operating costs of all-electric apartments are basically the same as the dual-utility costs now paid by tenants in their present apartment projects.

Then, the big sales punch with owners is: "All-electric apartments are modern today, they will be modern tomorrow and for years to come." Builders have been quick to recognize this very important all-electric feature.

The third factor contributing to the increase in all-electric apartment units is the growing public acceptance of the all-electric concept. People are now demanding the many advantages and conveniences that only electricity can provide. The heart of the all-electric apartment is the electric heating system and the public is beginning to realize that electric heating is unequaled in cleanliness, safety and convenience. Apartment dwellers can now enjoy electric comfort heating with individual room temperature control. For the building owner, the equipment is practically maintenance free.

A couple of examples will serve to illustrate what is taking place and the reaction of builders and oc-

(*Continued on page* 78)



simplify installation... reduce inventory

with BLACKBURN PARALLEL GROOVE CLAMPS

TWO sizes make up to 90% of the tap connections required on most distribution systems.

Tools normally carried by linemen are all you need to install Blackburn parallel groove clamps easily and properly. The problem of finding the right die inserts for specific connections is eliminated . . . the chance of human error is lessened.

Inventories can be reduced drastically. Only TWO clamp sizes take wire sizes from 8 solid to 336.4 ACSR, with taps from 8 solid to 1/0 ACSR.

Use these clamps on **aluminum** . . . also on **aluminum to copper** when prefilled with Contax, an oxide-inhibiting paste non-injurious to natural rubber. This also simplifies stocking, reduces the types of clamps needed in warehouses and on line trucks.

For the few installations outside 8 solid—336.4 ACSR main and 8 solid—1/0 ACSR tap range, other sizes are available.

Blackburn parallel groove clamps are engineered for high resistance to weathering, galvanic corrosion, vibration and other enemies of good connections. Construction is of high-strength aluminum alloy, with rocker and spring action to counteract differences in coefficient of expansion when used for bi-metallic connections.

For complete information and test data, send for Bulletin #6007. Samples on request.

Jasper

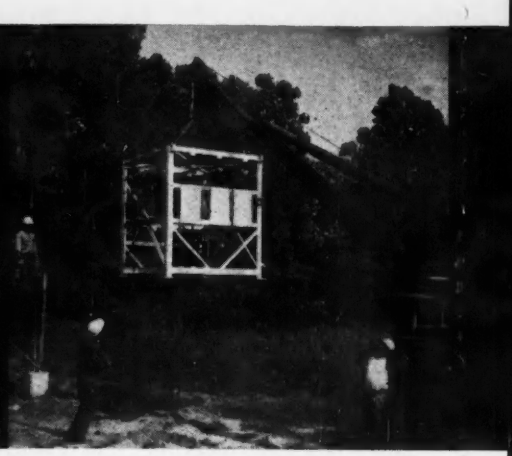
BLACKBURN

Corporation

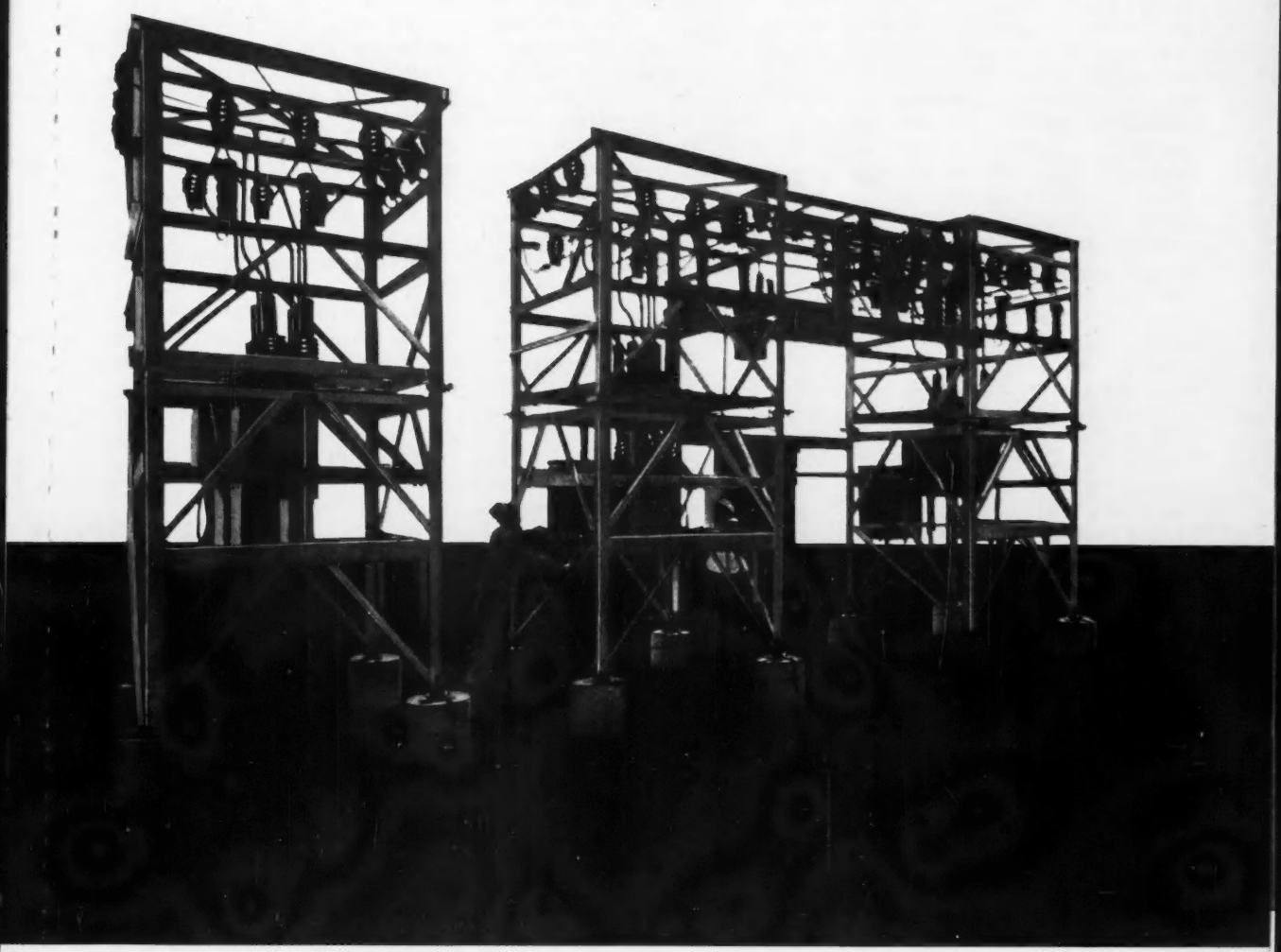
1525 Woodson Road • Saint Louis 14, Missouri

"We saved in equipment cost and erection time with these new PR Recloser Aluminum Feeder Structures"

Mr. Chester L. Williams, District Engineer, Union Electric Company, St. Charles, Missouri



Westinghouse PR Recloser Feeder Structure being installed in Mark Twain Substation of Union Electric Company.



New Westinghouse PR Recloser Feeder Structures are shipped in two sections as a complete package for the low voltage side of a 15 kv distribution substation. The cost is about 25% less than conventional methods of using other types of equipment, fabricating steel structures, assembling and wiring associated equipment and bus work. Installation requirements have been so simplified that Union Electric used a three-man crew for the job shown above. After bolting the four legs of the lower section to prepoured concrete supports, they hoisted the upper section of each recloser into place and bolted the two sections together. Elapsed time —about an hour for each recloser structure.

Each aluminum section is factory assembled and wired. You need only bolt them together then connect the transformer leads and incoming feeder leads. Each unit has dead end supports for feeder conductor, a PR recloser, lightning arresters and feeder metering equipment.

Periodic maintenance operations are simplified with the draw-out construction of the PR feeder structure. A simple tank lifter operation then lowers the recloser and disconnects the draw-out contacts—the recloser is visibly safe for maintenance.

Get more information. Call your Westinghouse Sales Engineer or write for Descriptive Bulletin 38-730. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. You can be sure . . . if it's Westinghouse.

J-65003

Westinghouse

cupants of electric comfort heated apartments.

One group of 40 apartment units was developed and built by the Julian LeCraw Building Co and has forced air baseboard electric heaters in the living area, and convection baseboard electric heaters in the bedroom areas. Openings and circuits were provided for through-the-wall air conditioners to be installed by tenants. These buildings were insulated to electric heating standards with six in. of batt type insulation in the ceiling, 3⅝ in. of mineral wool batts in all exposed walls and two in. of rigid perimeter insulation around the concrete slab floor. Double glazed windows were used and all windows and doors were well weather stripped.

The project has one- and two-bedroom apartments. The two-bedroom units have 7 kw of resistance heating for approximately 850 ft of living area. The one-bedroom units have 6 kw of resistance heating for approximately 800 sq ft of living area.

An engineering estimate of the expected operating costs on these units is shown in Table 1 below.

Service switches and metering presented one design problem. There were eight apartment units to a typical building, requiring a 600-amp main electrical service. Water heating is on a special rate and is separately metered. With eight apartment meters, eight water heater meters and one house meter for hall and building lights, the total was 17 meters and accompanying switches. Space prohibited the location of this amount of service equipment on the exterior of the building. therefore, a specially designed, 600-amp capacity free-standing panel board with all switches and meter positions for this installation was built (see photo, p 74). This solved the space limitation problem and resulted in a more economical and more attractive installation.

Time and Cost Savings Cited

One of the many favorable comments by LeCraw on his first group of all-electric apartments concerned the ease of construction because of the elimination of all vents and flues and gas piping and the ease of installation of the electric heating units. He felt that this had resulted in considerable savings in time and construction cost.

LeCraw also commented on the favorable acceptance of a new budget billing procedure which was initiated by Georgia Power on this project as a trial case at his request. Basically this budget billing procedure consists of an average monthly billing to each tenant who wishes to participate and is based on an engineering estimate of the yearly electrical cost for each apartment unit. On this particular project, it was estimated that the cost would average approximately $20.00 per month including all costs of cooking, water heating, heating and cooling as well as miscellaneous electrical usage. Customers were to be billed this average amount for a period of 11 months with a lump sum settlement in the twelfth month, based on meter readings for the yearly period.

LeCraw weighed this factor heavily in his decision to build all-electric apartments since he felt that it would better enable tenants to budget their monthly expenses. So far, the actual electrical consumption has been well within the engineering estimate for the project.

The second group of all-electric apartments consisted of 21 apartment units located on Fourth Ave in Decatur, Georgia, in the metropolitan Atlanta area. These were developed and constructed by Sharwell, Inc.

Heating is with forced-air electric resistance baseboard heaters with individual room control. Through the wall air conditioners were used in conjunction with the electric heating to give year-round comfort conditioning. Each two-bedroom unit, approximately 850 sq ft of living area, has 9 kw of resistance heating.

Table 1—Estimated Monthly Electrical Usage and Billing*

	Estimated Heating Costs (2 Bedroom Unit)		Estimated General Use Lights, Cooking And Misc.		Estimated Water Heating		Monthly Total	
	Kwhr	$	Kwhr	$	Kwhr	$	Kwhr	$
January	1,450	21.78	240	6.22	320	3.64	2,010	31.64
February	1,120	17.38	240	6.22	300	3.43	1,660	27.03
March	855	11.96	240	6.22	280	3.23	1,375	21.41
April	174	1.81	240	6.22	260	3.01	674	11.04
May	0	0	240	6.22	240	2.80	480	9.02**
June	0	0	240	6.22	240	2.80	480	9.02**
July	0	0	240	6.22	240	2.80	480	9.02**
August	0	0	240	6.22	240	2.80	480	9.02**
September	0	0	240	6.22	260	3.01	500	9.23**
October	108	1.12	240	6.22	280	3.23	628	10.57
November	898	12.67	240	6.22	300	3.43	1,438	22.32
December	1,420	21.32	240	6.22	320	3.64	1,980	31.18
Yearly Total	6,025	88.04	2,880	74.64	3,280	37.82	12,185	200.50**

Estimated Average Monthly Bill $16.71 (Does not include energy used for air conditioning)
*Includes fuel adjustment (10/1000ths of a cent per kwhr) and sales tax
**Plus cost of energy used for air conditioning
Heating estimate is based on an average Atlanta winter and on maintaining a 70F, inside temperature. (For two-bedroom downstairs end unit—maximum exposure)

A 400-amp electrical service was installed to each building and the quick-recovery electric water heaters again were separately metered.

The buildings were insulated with 6 in. of batt-type insulation in the ceiling, 3⅝ in. of mineral wool batts in all exposed walls, and 2 in. of rigid perimeter insulation around the concrete slab floor. A 4-in. mineral wool batt was used between upper and lower apartments as a soundproofing as well as insulating material. The operating cost analysis for these apartments was almost identical to that shown for the LeCraw apartments.

Mr Bagwell, of Sharwell, Inc, stated that one of the biggest plus features of electric comfort heating from a builder's standpoint was the absence of maintenance problems on these all-electric units. He liked the idea of "practically nothing to break down and not even a filter to change."

In personal interviews with a number of the tenants on these two projects during the first winter, the author received many favorable comments on the advantages of all-electric living.

One mother expressed her pleasure in finding that she could maintain any temperature she desired in the baby's room without heating the entire apartment to that temperature. There were numerous favorable comments on the evenness of temperature maintained by the electric heating units and on the absence of that "hot, stuffy feeling" experienced in conventionally heated apartments.

These comments by both builders and families enjoying the many advantages of electric heating and all-electric living indicate that the all-electric concept in apartments is gaining momentum day by day.

Heating Cost Narrowed

Hydro-Electric Power Commission of Ontario has predicted 16,000 electrically heated homes by 1965, 64,000 by 1970, and 250,000 by 1980 with the adoption of a new 1.35¢ rate. This is expected to narrow the price between electric heat and gas and oil to between 15-20% higher, compared to a present difference of 25%.

Watthour meters are designed to do their job indefinitely. But occasionally repair may be required . . . a truck grazes the meter . . . a rock breaks the cover and dents the register . . . the meter is dropped, the disk bent. Whatever the cause, Sangamo sectionalized construction enables quick, easy, inexpensive repair.

Any major J3 component can be inspected or repaired without completely disassembling the meter or returning it to the manufacturer. There is no paper work delay; the meter is back in service quickly . . . reducing meter stocks.

Parts inventory? Kept to a minimum: all major J3 components (except frame and moving system) are interchangeable with the J2. You can even install J3 magnetic flotation on J2 meters. The economies of sectionalized construction are realized immediately when you standardize on the J3 . . . unsurpassed in metering values.

true MAGNETIC flotation J3

SANGAMO ELECTRIC COMPANY

SPRINGFIELD ILLINOIS

PW61-9

CREE DURGIN EDSON SCHILL

Vermont Utility Appoints Cree as Chairman

Central Vermont Public Service Corp has elected Albert A. Cree to the newly created position of chairman and chief executive officer.

Harold L. Durgin succeeded Cree as president, while Wayne M. Edson became vice president-operations and construction and Robert E. Schill was boosted to vice president-marketing.

Howard S. Lewis was promoted to chief engineer in charge of the engineering and planning division. He has been with Central Vermont PS since 1935.

Cree joined the company in 1935 as vice president and general manager. He has been president since 1936. With Central Vermont PS since 1929, Durgin has been executive vice president for 11 years.

Edson, who came to the utility in 1937, was most recently chief engineer and operations manager. Schill has been assistant to the president since 1956, when he joined Central Vermont PS.

Potomac Edison Promotes Urner to Vice President's Position

Martin J. Urner has been elected vice president in charge of engineering and power production for Potomac Edison Co.

Urner joined Potomac Edison 26 years ago, serving in the substation construction department. He served in various capacities in the utility's engineering sector and, three years ago, was promoted to manager of transmission and distribution. Last year Urner was elected assistant vice president.

URNER

Federal Pacific Electric Names Three as Vice Presidents

ASHMAN BISIGNANI BURKE

Federal Pacific Electric Co has appointed three commercial vice presidents: Harry W. Ashman, manager of government sales and contracts; Armond J. Bisignani Jr, manager of mixed-apparatus contracts; and B. S. Burke, manager of the central region.

Ashman joined Federal Pacific in 1957. He is a member of the executive committee of the New Jersey division of

(*Continued on next page*)

the American Institute of Electrical Engineers.

Bisignani has been with the company since 1954. He was formerly with a consulting engineers firm.

Burke came to Federal Pacific in 1957 after long association with Westinghouse Electric Corp, where he had served in such posts as switchgear distribution apparatus department manager and lighting division manager.

PERSONAL BRIEFS

Connecticut Light & Power Co has named **John W. Burg** as Housatonic division superintendent, **Thomas F. Keena** as central division superintendent, and **Emil B. Gross** as Housatonic division sales engineer.

Lawrence O. Houston Jr has been named a special assistant to the head of the Area Redevelopment Administration, US Department of Commerce. Houston will also have primary responsibility within ARA to work with the Labor and the Health, Education and Welfare Departments in developing job retraining programs in redevelopment areas.

C. T. Eyford has been appointed projects manager of British Columbia Electric Co. He was succeeded by **Herbert E. Sladen** as distribution engineering superintendent.

Marshall E. Fahlstrom has been promoted to manager of Skagit operations for Seattle City Light.

Virginia Electric & Power Co has appointed **Ivan Hall** as Blue Ridge district manager at Charlottesville, replacing **George F. Duborg** who was recently elected vice president in charge of Vepco's Western Division (EW, Sept. 11, p 80).

Minnesota Power & Light Co has added an agricultural engineering service to its farm program. **Paul J. Shea** was named to the newly created post of agricultural engineer.

A. F. Darland has retired as power supervisor at Grand Coulee Dam and been succeeded by **Erick A. Benson.**

(*More News About People on p* 82)

What does CF&I Galvanized Strand have in common with ducks?

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AEP Service Corp Revamps Department

American Electric Power Service Corp has reorganized its engineering department, creating two new engineering divisions and realigning duties in other divisions.

Carl P. Zimmerman, who has been named chief engineer, heads the engineering department.

Functions of the design division have been divided between the two newly created divisions: civil engineering, and design and drafting services. Mark J. Hroncich is acting head of the former, and John E. Dolan heads the latter.

John A. Tillinghast was promoted to head of the mechanical engineering division, and Howard C. Barnes became electrical engineering division head. Robert S. Hunter succeeded Tillinghast as project engineer for Tanners Creek Unit 4.

E. A. Kammer, former head of the design division, was designated consulting civil and design engineer; T. T. Frankenberg, formerly head of the mechanical engineering division, was appointed consulting mechanical engineer; and John H. Kingborn, deputy head of the electrical engineering division, was named consulting engineer.

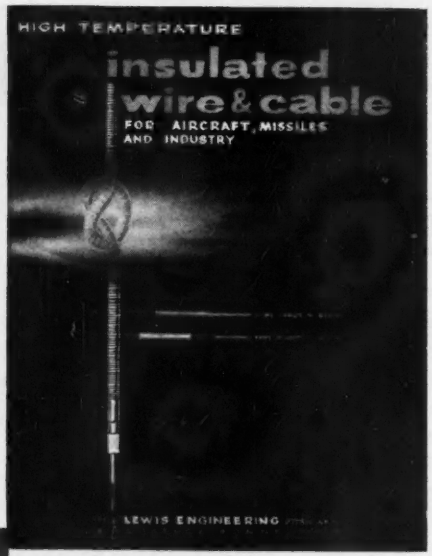
The Canton (Ohio) engineering office was redesignated as the Canton engineering division, while the computer applications section became the computer services section, with Glenn W. Stagg as its head. Previously part of the system planning and analytical division, the new computer services section will now report to the chief engineer.

Construction Work Shifted

Also, most electrical construction work has been removed from the construction division. Robert E. Bair, newly named transmission line construction manager, and Richard C. Miller, new substation construction manager, will report to the chief engineer. Power plant substation construction remains in the construction division.

DESIGNERS and ENGINEERS:

write for this brand new data on flexible, high temperature resistant wire and cable for hypersonic vehicles, or special industrial applications.



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Terafilm—an important new polyester film—comes to you from a new, controlled-atmosphere plant. Here's what this means:

Terafilm is a remarkable new plastic development. Dimensionally stable, it has superior resistance to moisture and heat. Electrical insulating properties are outstanding. Capacitors wound with **Terafilm** were left uncased and subjected to temperature and humidity conditions under which capacitors wound with another polyester film deteriorated completely in eight days. After 21 days, those wound with **Terafilm** were still intact.

Terafilm also accepts printing and metalizing, has excellent chemical resistance, and can be laminated to other materials. Thus, its possibilities range over packaging, magnetic tape, metallic yarns, and other functional and protective electrical applications—wire, cable, capacitors, coils, slot liners, tape...

Rigid quality control is the key to the outstanding performance of **Terafilm.** It is made of Eastman Tenite Polyester in a dust-free controlled atmosphere employing the most precise production techniques. You can expect its quality and service properties to conform to the most exacting standards. **Terafilm** is available in any quantity you desire, and for samples of the film or sheet, and detailed information at no obligation, write today.

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TODAY...

Tenite Polyester—a remarkable new plastic—
is being made into an important new film.
Here are some facts you should know:

With Tenite Polyester, Eastman launches a new plastic material. Today, it is already being made into biaxially oriented film by Terafilm Corporation, Stamford, Connecticut. This is an extraordinary plastic film—an extraordinary *polyester* film.

It can be applied to many of the familiar uses for plastic films. But it will also accomplish many unusual tasks with impressive results, chiefly because Tenite Polyester itself possesses such unusual properties. This table will give an idea of some test results:

Typical Physical Properties of 1-mil Film

	25°C	−50°C
Density, g/cc	1.226	
Refractive index	1.59	
Tensile—Yield Strength, psi	10,000	15,000
Strength at break, psi	17,000	20,000
Elongation at break, %	45	40
Modulus, 10^5 psi	4.0	4.5
Tear strength, g/mil	6	
M.I.T. fold endurance, cycles	10,000	
Burst strength, psi	56	
Moisture absorption—24 hr at 25°C, %	0.3	
Water vapor permeability—g-mil/100 in^2/day	1.8	
Flammability	Will not sustain flame due to melting (ASA burning rate)	
Color	Brilliant water-white	
Resistance to degradation by steam—	No change after 8 days at 110°C and 100% R. H.	
Heat-distortion temperature, 2% at 50 psi	170°C	
Dielectric strength, 1-mil, 500 v/sec, 60-cycle	6,500 v/mil	
.5-mil, 500 v/sec, 60-cycle	9,000 v/mil	
Corona resistance, 1-mil, 2,000 volts, 60-cycle	150 minutes	
Insulation resistance, 100°C, 100 volts, 5-min electrification	$>10^4$ megohm microfarads	
Dissipation factor, 1.0 kc, 100°C	0.006	
Capacitance increase, %, 100°C	2.0	

You might compare these figures with those on hand for any other plastic film. But there are additional facts well worth knowing, and they can best be evaluated by seeing the film and reading about what it can do. Generally, the story adds up to this:

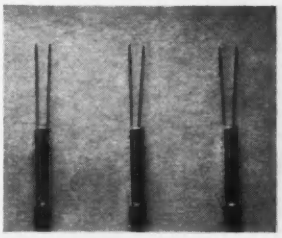
New Electrical Benefits

Film of Tenite Polyester is brilliantly clear and glossy. It has excellent dimensional stability along with high heat-distortion temperature and low moisture absorption. Its electrical properties are most impressive.

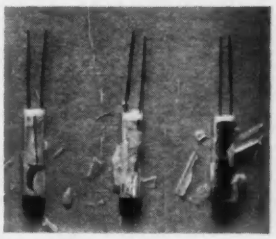
Film made from Tenite Polyester possesses a high dielectric strength along with an extremely stable dissipation factor and dielectric constant. These properties, together with its excellent resistance to chemicals and moisture, provide important new benefits when the film is used as an insulating winding for wire, cable, capacitors, and coils, and as slot liners and tape. Dielectric constant of the film is about 3.1, while a typical value for dielectric strength is 9000 v/mil at 60 cycles and 500 v/sec for 0.5-mil film.

Unusual Performance

Eastman laboratories tested capacitors made from film of Tenite Polyester in comparison with those made of another polyester film. In both tests, the capacitors were uncased and were held at 110° C and 100% humidity. Results after eight days are shown here. After 21 days of this treatment, the capacitors made from Tenite Polyester were still intact. The properties demonstrated by these tests mean substantial savings in making capacitors; the case of a conventional capacitor is a major item in its cost.



Tenite Polyester



Other Film

Similar uncased capacitors were made with film of Tenite Polyester for a commercial TV set, an electric organ, two radios, and several industrial controllers. The TV set is programmed to run nine hours per day, the organ 24 hours per day, and the radios and controllers are in intermittent service. Since testing began some three years ago, not a single failure or defect in operation has occurred.

See for Yourself

These properties of Tenite Polyester hold many new and desirable advantages for the electrical and electronic industries. In making your own appraisal of the film firsthand, you may wish to have samples and detailed information. Just write Terafilm Corporation, Canal and Ludlow Streets, Stamford, Connecticut, extruders of Tenite Polyester supplied by EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

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Meetings Calendar

OCTOBER

American Institute of Electrical Engineers—Fall General Meeting, Statler-Hilton Hotel, Detroit, Mich., Oct. 15-20.

National Rural Electric Cooperative Association—Region VI Meeting, Bismarck, North Dakota, Oct. 16-17; Region VII Meeting, Cheyenne, Wyoming, Oct. 19-20; Region II Meeting, Miami Beach, Florida, Oct. 30-31.

National Safety Council—Annual Meeting, Chicago, Ill., Oct. 16-20.

Northwest Electric Light & Power Association—Business Development Section, Davenport Hotel, Spokane, Wash., Oct. 16-18.

Electric Council of New England—5th Annual Conference, Hotel Somerset, Boston, Mass., Oct. 18-20.

Wisconsin Utilities Association—Operating and Sales Convention, Schroeder Hotel, Milwaukee, Wis., Oct. 18-20.

Illinois Municipal Utilities Association—Fall meeting, St. Nicholas Hotel, Springfield, Ill., Oct. 19-20.

National Society of Professional Engineers—Fall Meeting, Hotel Roanoke, Roanoke, Virginia, Oct. 19-20.

Pennsylvania Electric Association—Business Development Section, Bedford Springs, Penn., Oct. 19-20; Meter Committee, White Swan Hotel, Uniontown, Penn., Oct. 19-20; Prime Movers Committee, Hotel Thayer, West Point, New York, Oct. 19-20; Relay Committee, Hotel Penn Alto, Altoona, Penn., Oct. 26-27.

Edison Electric Institute—Electrical System & Equipment Committee, Jack Tar Hotel, San Francisco, Oct. 23-24; Home Service Committee, Chicago, Ill., Oct. 24-25; Sales Division Executive Committee, New York, N. Y., Oct. 31.

• **Canadian Electrical Association**—General & Sales Sections, Hotel Bessborough, Saskatoon, Oct. 26-27; Engineering Division Sections, Macdonald Hotel, Edmonton, Oct. 30-31.

NEMA—Industrial Electronics & Communications Equipment Division, Edgewater Beach Hotel, Chicago, Oct. 26.

Pacific Coast Electrical Association—Hawaiian Conference, Princess Kaiulani Hotel, Honolulu, Oct. 26 27.

Kansas Association of Municipal Utilities—Annual Convention, Wichita, Kansas, Broadview Hotel, Oct. 29-31.

NOVEMBER

• **NEMA**—Wire & Cable Division, Seaview Country Club, Absecon, N. J., Nov. 1-3; Industrial Equipment Division, Edgewater Beach Hotel, Chicago, Nov. 1-8; Codes & Standards Committee, NEMA Office, New York City, Nov. 9-10; Lighting Equipment Division Meeting, Belmont Plaza Hotel, New York City, Nov. 13-15; Annual Meeting, Plaza Hotel, New York City, Nov. 16; Generation, Transmission & Distribution Equipment Division, Shoreham Hotel, Washington, D. C., Nov. 27-29.

• **National Rural Electric Cooperative Association**—Region Eight Meeting, New Orleans, La., Nov. 2-3; Region Nine Meeting, Sacramento, Nov. 6-7.

• **Southeastern Electric Exchange**—Personnel Administration Section, Tampa Section, Tampa International Inn, Tampa, Florida, Nov. 2-3; Sales, Advertising & Public Relations Conference, Tides Hotel, St. Petersburg, Florida, Nov. 15-17.

• **American Institute of Electrical Engineers**—Western Appliance Technical Conference, Biltmore Hotel, Los Angeles, California, Nov. 6; AIEE-IRE 6th Annual Technical Conference on Non-Linear Magnetics, Statler-Hilton Hotel, Los Angeles, California, Nov. 6-8; Magnetism and Magnetic Materials Conference, Westward Ho Hotel, Phoenix, Nov. 12-16.

• **Edison Electric Institute**—Accident Prevention Committee, Tutwiler Hotel, Birmingham, Alabama, Nov. 6-8; Area Development Workshop, Miami, Florida, Nov. 14-15; Area Development Committee, Miami, Florida, Nov. 15.

• **New Jersey Utilities Association**—Annual Meeting, Seaview, Country Club, Absecon, Nov. 8-9.

• **Electric Companies Public Information Program**—Third National Youth Conference on the Atom, Palmer House, Chicago, Nov. 9-11.

• **Air Conditioning & Refrigeration Institute**—Annual Meeting The Homestead, Hot Springs, Va., Nov. 12-15.

• Additions this week.

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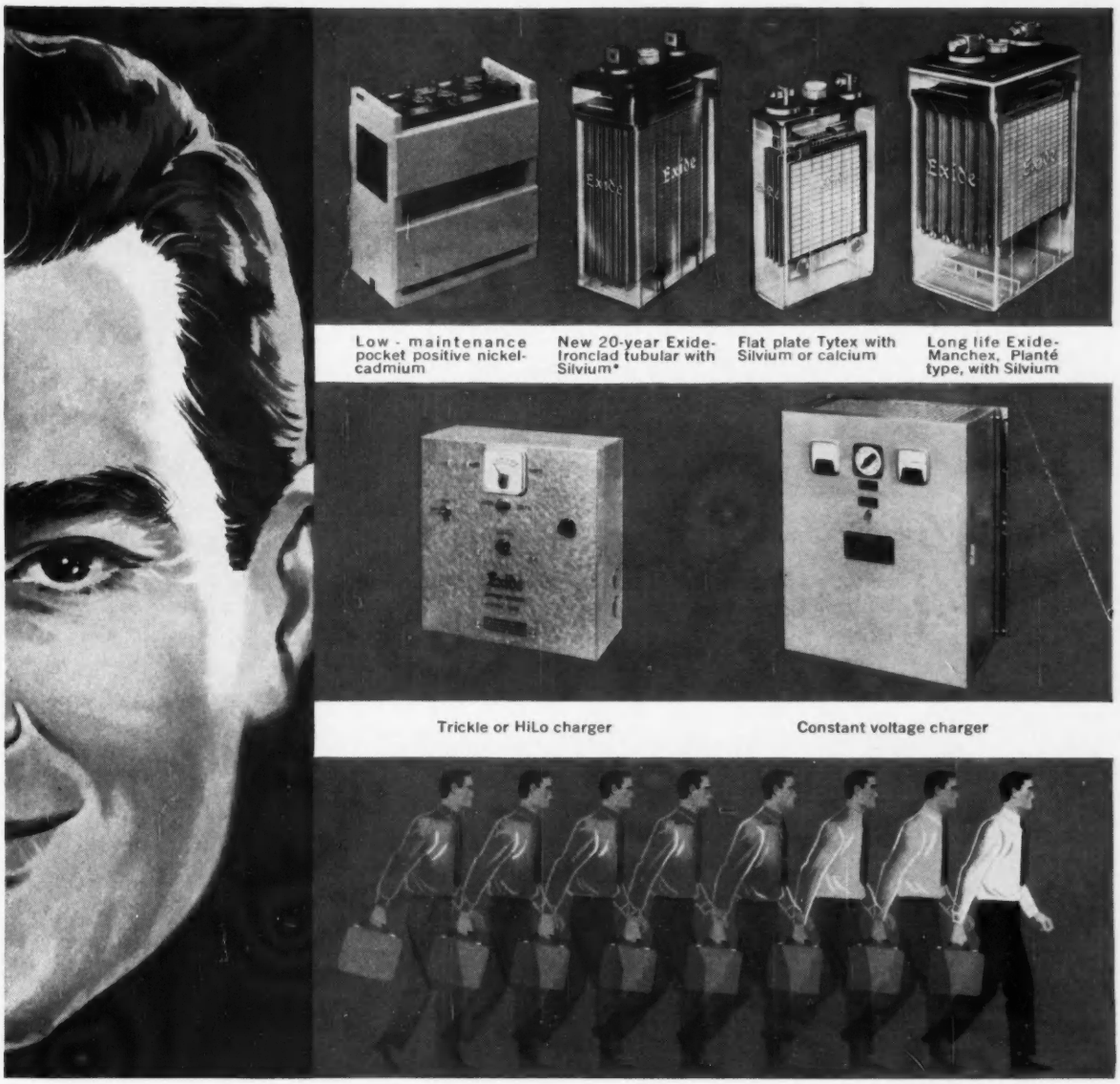
Low - maintenance pocket positive nickel-cadmium
New 20-year Exide-Ironclad tubular with Silvium*
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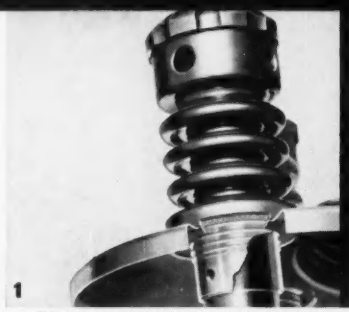
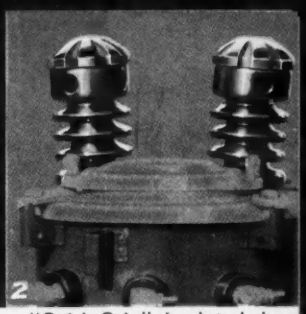
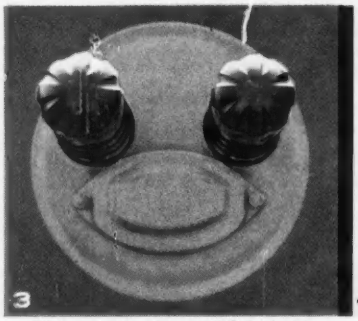
12 Reasons Why You Get extra value in Kuhlman Transformers



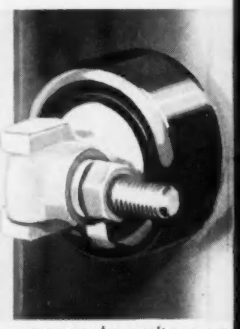
Oil-less radio noise free bushings with internal clamping sleeve.



"Quick-Grip" insulated hand connectors.

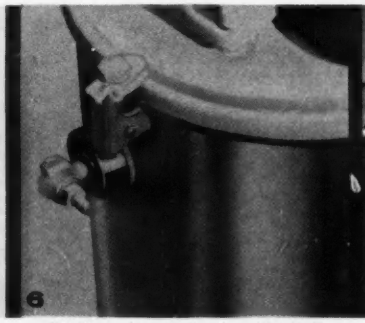


Bird and animal-proof "Celuclad" covers.

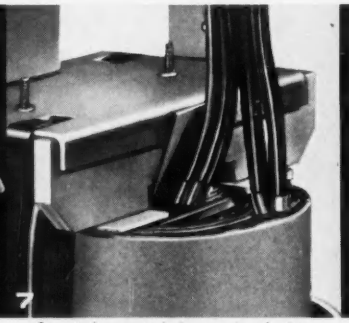


Spring-pressure low voltage con nectors for copper and aluminur conductors.

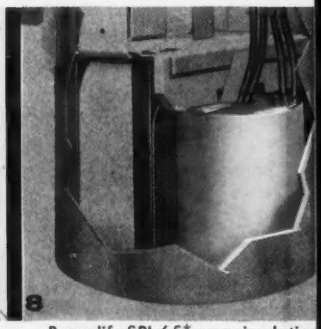
Special insulated and shielded primary windings with greater ability to withstand lightning and switching surges.



Brighter, longer lasting "Lucite" finish.

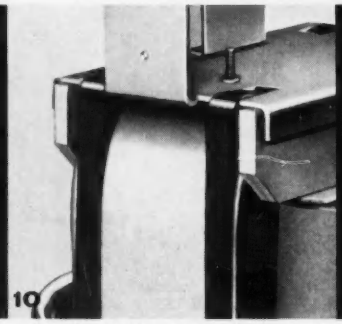


Special coated layer insulation resulting in improved short-circuit capability.

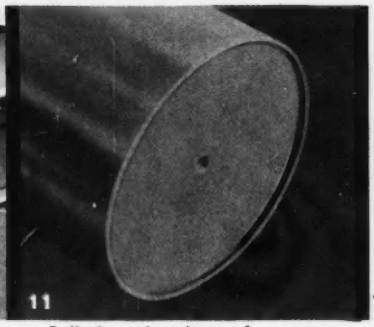


Bonus life SPI-65* super insulation

Gleaming white interiors that let you see right to the bottom of the tank.



Low-loss Kuhlman core with better performance guarantees.



Rolled under base for easy handling.

Lighter, smaller designs that ar more economical to operate an maintain.

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